CHEESE FACTORY LIST, 1930

Name of Factory	Location	Name of Proprietor	Address of Proprietor	Name of Cheesemaker	Address of Cheesemaker
Allamakee County—					
Forest Mills Cheese Co.....c	Postville.....	Postville State Bank	Postville.....	E. E. Austin.....	Postville
Hanover Cheese Co.....c	Dorchester.....	T. J. Fitzgerald, Mgr.	Dorchester.....	O. Stenhart	Dorchester
Crawford County—					
Armour Creameries .....een	Denison.....	Armour & Co.....	.....	.....	.....
Delaware County—					
Tom May Cheese Factory.....!	Thorpe.....	Tom May	Manchester.....	.....	.....
Humboldt County—					
Pioneer Cheese Factory.....!	Renwick.....	Theodore Mahler	Renwick.....	Theodore Mahler ...	Renwick
Jones County—					
Anamosa Cheese Factory .....!	Anamosa.....	Board of Control....	Des Moines.....	John Hinz	Anamosa
Linn County—					
Central City Butter & Cheese Co.....!	Central City.....	Earl George	Central City.....	T. J. Freeman.....	Central City
Marshall County—					
C. N. Nielson Creamery.....!	Marshalltown.....	N. C. Nielson.....	Marshalltown.....	.....	.....
Mitchell County—					
Jamestown Cheese Factory.....!	Riceville.....	John Stettler	Riceville.....	John Stettler	Riceville
Story County—					
Iowa State College.....!	Ames.....	Prof. Mortensen, Head Dairy Dept...	Ames.....	.....	.....
Webster County—					
Ft. Dodge Creamery Co.....een	Ft. Dodge.....	A. B. Sayles, Mgr...	Ft. Dodge.....	Joe A. Trost.....	Ft. Dodge
Winneshiek County—					
Frankville Farmers Cheese Co.....!	Postville, R. D.....	J. E. Kneeskern, Sec.	Postville, R. 3.....	Mart Winger	Postville
Freeport Cheese Co. .....!	Decorah.....	E. J. Hruska.....	Decorah.....	C. H. Keipers.....	Decorah

CONDENSED MILK LIST

Name of Factory	Location	Name of Proprietor	Address of Proprietor
Carnation Milk Products Company.....	Waverly.....	Paul R. McKee, Sec.	720 State St., Chicago, Ill.
Perry Milk Products Company.....	Perry.....	H. Spurgeon, Mgr.	Perry, Iowa

U. S. DEPARTMENT OF AGRICULTURE
WEATHER BUREAU AND
BUREAU OF AGRICULTURAL ECONOMICS

In Co-operation with the

Iowa Weather and Crop Bureau

Annual Report for 1929

Reprint Part XVII of the Thirtieth Annual Iowa Year Book of Agriculture

CHARLES D. REED, M. Sc. Agr.

Published by
THE STATE OF IOWA
Des Moines

LETTER OF TRANSMITTAL

HON. JOHN HAMMILL, *Governor.*

SIR: I have the honor to submit herewith the fortieth annual report of the Iowa Weather and Crop Bureau for the year 1929.

MARK G. THORNBURG,
Secretary of Agriculture.

Des Moines, Iowa, January 15, 1930.

HISTORICAL

The Iowa Weather and Crop Service was established by an Act passed by the Twenty-third General Assembly, and approved by the Governor April 25, 1890. On July 1, 1923, it became a bureau of the State Department of Agriculture by act of the 40th General Assembly.

The object of the Service is to co-operate with Government Bureaus in collecting crop statistics and meteorological data, and more widely disseminate weather forecasts and storms and frost warnings for the producers and shippers of perishable products, and to promote general knowledge of meteorological science and the climatology of the State.

In accordance with the Act, on the recommendation of the directors of the State Agricultural Society, J. R. Sage was duly commissioned as director by Governor Boies on June 3, 1890, and General Greeley, then Chief Signal Officer, U. S. Army detailed Dr. George M. Chappel to serve as assistant director of the State Service. Mr. J. R. Sage resigned as director December 31, 1907, and Dr. George M. Chappel was commissioned on January 1, 1908, as director, and served in that capacity until March 31, 1918, when he resigned and was succeeded by Charles D. Reed. Toward the close of the year, 1919, co-operation in estimating acreage and production of crops was begun with the U. S. Bureau of Markets and Crop Estimates now known as the U. S. Bureau of Agricultural Economics, of which Mr. Leslie M. Carl is Agricultural Statistician for Iowa.

OFFICE FORCE DECEMBER 31, 1929

Charles D. Reed, M. Sc. Agr., Senior Meteorologist and Director.
J. Earl Cook, Statistician.
Hildur Renner, Stenographer.
Mildred T. Cannon, Stenographer.

CO-OPERATING ORGANIZATIONS

U. S. Weather Bureau

Fred L. Disterdick, Assistant Meteorologist.
Norbert G. Ribble, Observer.
Sterling R. Hatch, Junior Observer.
Milton L. Blanc, Junior Observer.
Wayne H. Bartlett, Minor Observer.

U. S. Bureau of Agricultural Economics
Division of Crop and Live Stock Estimates

Leslie M. Carl, Agricultural Statistician for Iowa.
Julius H. Peters, Associate Agricultural Economist.
Gwen Sayler, Assistant Clerk.
Mildred S. Baldridge, Junior Clerk.
George Meader, Clerk.

ANNUAL REPORT, 1929

For convenient reference and comparison with past and future years, this report contains summaries of the weekly, monthly and annual bulletins of the Weather and Crop Bureau of the Iowa Department of Agriculture, in co-operation with the Weather Bureau and the Bureau of Agricultural Economics both of the United States Department of Agriculture, for the year 1929. Parts XVII, XVIII and XIX of the Year Book were prepared by the Weather and Crop Bureau as usual. Part XVIII, presenting in extensive tables and maps the agricultural statistics of 1929, gathered by assessors under the direction of the Weather and Crop Bureau, will be published in the "Iowa Monthly Crop Report" for June, 1930. Part XIX of the Year Book, summarizing the statistics of the main crops of Iowa for all years of record, is revised and brought up to date.

Crop acreages within the counties are rather stable. There is no great need for county estimates in advance of the returns from assessors, so advance county estimates have been abandoned till further need arises. Live stock estimates by counties have been discontinued as impractical. Live stock estimates for the state as a whole, on January 1, 1930, and live stock marketed from Iowa and live stock shipped into Iowa during the year, 1929, will be published in the "Iowa Monthly Crop Report" for January, 1930, and appear in the 1929 Year Book.

WEATHER FORECASTS AND WARNINGS

Weather forecasts were distributed daily by newspapers and eight radio stations in or near Iowa. No other state has such a wide distribution of forecasts by radio broadcasting stations and probably no other state has so many receiving sets in rural homes—about one for each second farm. The action of the Federal Radio Commission in taking station WOI off the air at night, and causing stations WOC and WHO to divide time at night, has greatly impaired the distribution of forecasts.

CLIMATE AND CROP WORK

The usual weekly and monthly weather and crop bulletins were prepared and published. Iowa is getting drier, particularly in the southwest and west-central districts, as shown by the paper "Secular Trend of Iowa Precipitation," read by Director Charles D. Reed

before the meeting of the American Meteorological Society which met as one section of the American Association for the Advancement of Science in Des Moines, December 27, 1929. This paper, with 11 illustrations, appears elsewhere in this publication. It will also be published in the Monthly Weather Review, Washington, D. C. Lantern slides prepared from the illustrations are available for loan to schools and elsewhere, without cost.

TESTING CORN FOR MOISTURE

Testing well distributed and selected samples of shelled corn for moisture continued in the fall of 1929, as in 1928. Composite samples numbering 158, from 93 counties, 1,218 fields, and 9,669 ears on an average date of October 11, 1929, showed 28.1% of moisture, or 4.7% more than a similar test in 1928. The November composite samples numbering 146, from 89 counties, 901 fields or cribs, and 7,597 ears on an average date of November 20, showed 21.2% or 1.4% more than in 1928. This affords a means of refining the estimates of yield by reducing to standard grades. Details of these tests will be found elsewhere in this publication.

HAILSTORM AND TORNADOES

Hail and tornado statistics continue to be outstanding features of the work. The fine spirit of co-operation shown by the farmer crop reporters, nearly one for every township in the state, makes it almost impossible for a hailstorm, windstorm, damaging straight wind or flood of importance, to escape notice, and the facts soon reach the office of the Weather and Crop Bureau. Later the township assessors inquire of each of about 211,000 farmers as to the loss sustained by hail. The hail data are being tabulated by townships so that when 20 years of record become available (in about 12 years from now) definite conclusions can be reached as to whether there are zones and areas where hail damage is more or less prevalent. At present there is much difference of opinion.

Facilities for collecting tornado reports are so much better than in other states that the number of tornadoes reported is outstandingly large. The annual report of the Chief of the United States Weather Bureau for 1928 says relative to the Iowa tornadoes: "The count indicates 45 tornadoes during 1928, more than ever otherwise reported for a single state within one year." It should be stated in this connection that discretion is used in calling a storm a tornado. About half of the storms reported by the press as tornadoes are only squalls along a wind shift line, or "derechos"

as they were called by Dr. Gustavus Hinrichs, Director of the Iowa Weather Service, 1875-1889, which was the forerunner of the Iowa Weather and Crop Service.

The presence or absence of true tornadic characteristics such as a pendent, funnel-shaped cloud, rotary winds, debris lying in opposite directions, width of path, normal direction of movement, normal time, etc., are given careful weight and consideration before a storm is finally recorded as a tornado, though many untrained observers may report it as such. In spite of this careful screening, 29 tornadoes are tabulated and mapped, elsewhere in this report for the year 1929, but most of them caused little damage, the total for the 29 storms being $313,850, with 3 people killed and 27 injured.

CLIMATOLOGY OF THE YEAR

The mean temperature of the year 1929 for the State of Iowa as a whole, was 46.4°, or 1.6° below normal. January, February and November produced most of the deficiency in temperature, though May, June and September were also deficient. March and April were noticeably warmer than normal, and July, August and December slightly warmer. The mean temperature of the crop season, May to September inclusive, was 66.5° or 1.3° below normal. The average length of the growing season for the state between the average date of last killing frost in spring, May 13, and the average date of first killing frost in autumn, September 28, was 138 days, or 17 less than the normal. Eighty-five per cent of the corn escaped frost damage.

Precipitation averaged 30.20 inches, or 1.95 inches less than the slightly revised normal. Excessive rains in April hindered spring seeding and planting. Excessive snows in January and February, the greatest since records began in 1892, greatly reduced transportation and marketing and caused spring floods in many places. The state average snowfall for the year was 41.8 inches, or 11.1 inches above the normal, and the greatest since records began in 1892, except in 1909, which had 49.0 inches. The greatest total snowfall of the year, 75.8 inches, occurred at Northwood, Worth County. Sunshine was deficient or just normal in all months, but August and November, which had slight excesses. Hail, tornado and storm damage generally was less than in 1928.

Corn did not yield as well as in 1928, but the cool weather crops, such as oats, wheat, hay and potatoes, yielded well.

AVERAGE TEMPERATURE DEPARTURE
State of Iowa, Year, 1929

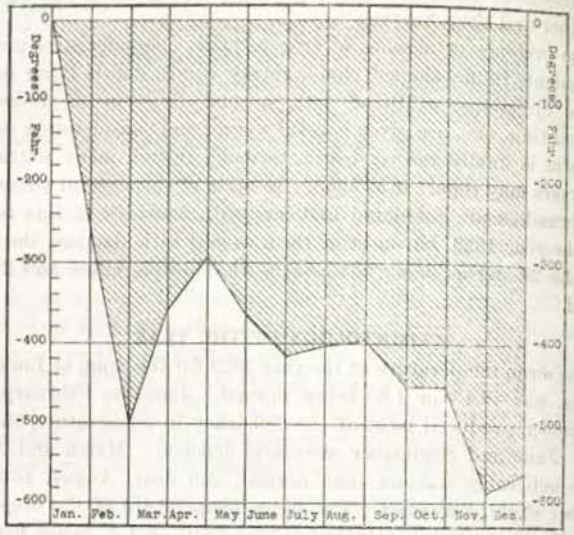


Figure 1.—Line bounding shaded area shows accumulated departure of temperature from normal. Upward slope means temperature above normal; downward, below.

BAROMETER: (Reduced to sea level). The average pressure of the atmosphere for the year was 30.04 inches. The highest pressure was 30.84 inches at Sioux City on November 21. The lowest pressure was 29.17 inches at Charles City on March 6, and Sioux City on April 5. The range for the state was 1.67 inches.

TEMPERATURE: The mean temperature for the state was 46.4° or 1.6° below normal. The highest annual mean was 50.6° at Keokuk, in Lee County. The lowest annual mean was 42.2° at Postville (near), in Clayton County. The highest temperature reported was 102° at Keokuk, No. 2 in Lee County, on August 22. The lowest temperature reported was —35° at Decorah, in Winneshiek County, on February 20. The range for the state was 137°.

PRECIPITATION: The average amount of rainfall and melted snow for the year was 30.20 inches, or 1.95 inches less than normal, and 5.76 inches less than the average for 1928. The greatest amount at any station was 44.24 inches at Burlington in Des Moines County, and the least amount was 20.57 inches at Sioux Center, in Sioux

AVERAGE PRECIPITATION
State of Iowa, Year, 1929

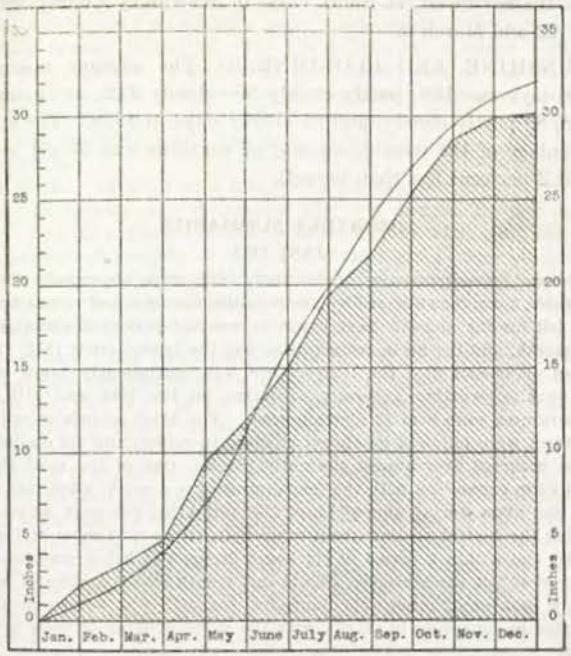


Figure 2.—Line bounding shaded area shows accumulated depth of precipitation in inches. Smooth curve shows normal.

County. The greatest monthly precipitation was 10.30 inches at Riverton, in Fremont County, in July. The least amount was 0.03 inch at Glenwood, in December.

The greatest amount in any 24 consecutive hours was 8.35 inches at Toledo, in Tama County, on August 2d. Measurable precipitation occurred on an average of 94 days, 6 days more than in 1928 and 9 days more than normal.

SNOWFALL: The average amount of snowfall was 41.8 inches. The greatest amount reported from any station was 75.8 inches at Northwood, in Worth County, and the least amount was 16.0 inches at Chariton, in Lucas County. The greatest monthly snowfall was 34.3 inches at Dubuque, in Dubuque County, in January.

WIND: The prevailing direction of the wind was from the

northwest. The highest velocity reported was 51 miles per hour from the northwest, at Sioux City, in Woodbury County, on January 22 and March 6.

SUNSHINE AND CLOUDINESS: The average number of clear days was 158; partly cloudy 95; cloudy 112; as against 180 clear; 89 partly cloudy, and 97 cloudy days in 1928. The average percentage of the possible amount of sunshine was 57 per cent, or about 2 per cent less than normal.

MONTHLY SUMMARIES

JANUARY

The main characteristics of January, 1929, were abnormally low temperatures, numerous and sudden temperature changes, and record breaking snowfall for the month. Severe winter weather prevailed almost the entire month, and the mean temperature was the lowest since 1918. Except for an occasional day, the temperature was continuously below normal, the warmest weather generally occurring on the 10th and 11th, when temperatures were 6 to 12 above normal. The brief periods of mild temperatures were followed by abrupt changes to colder, and six distinct cold waves occurred over almost the entire State. One of the most singular features in connection with the temperature was a warm wave that passed over the state during the night of the 10th-11th, the peak of the wave passing the central portion about midnight, with a maximum of from 36° to 39°, and within a period of six hours dropped to below zero, making a range of 40° at two stations. While this month was considerably warmer than a number of other cold Januarys, the cold was persistent and aggravated by numerous blizzards, with the worst drifting of snow in recent years.

The first, and by far the worst, blizzard, began on the 4th and continued until late on the 5th. A great many highways that were closed during this storm remained closed throughout the month. The main highways were kept open with the greatest effort, and owing to the lack of thawing the work of opening roads was required to be done over and over. One town in the northeastern portion of the state was completely isolated for a period of more than two weeks. Rail traffic was seriously interrupted and at times it was necessary to detour trains around impassable drifts to maintain service. One branch line in the northeastern portion was not able to operate for a period of ten days. It was reported that snowfall as light as one inch was sufficient to fill cuts from three to five feet by drifting. Snow fences were buried. The delivery of mail was impossible on a large number of rural routes, and on other routes the number of deliveries was greatly curtailed. Street car service in the larger cities was badly hampered and was temporarily suspended in many cases; a large number of automobiles were stranded, on the 5th, and it was not possible to move some for several days. All roads leading out of Des Moines were blocked with abandoned autos. Some that attempted to detour around drifts stuck in the snow where they remained at the end

of the month. It was impossible to remove the snow from the city streets, and the snow generally packed to the consistency of ice, which made travel very difficult and dangerous. Most travel was confined to single tracks, and the concentrated travel with heavy trucks equipped with chains did enormous damage to paving. The heavy snowfall damaged roofs and caused the suspension of all outside work except such as was absolutely necessary. The snow and unrelenting cold made it necessary to put all live stock on heavy feed practically the entire month. The consumption of feed was unusually large. The icy condition of the packed snow injured farm animals.

The monthly snowfall at a number of stations was the greatest ever reported in January, and at Dubuque the total was the greatest for any month. The ice harvest was completed during the month, but the snow cover added considerably to the cost of harvesting. The ground was generally frozen to unusual depths. The complete cover of snow made it impossible for birds to obtain feed, and large numbers perished in various portions of the state.

Temperature. The mean temperature for the State derived from the means of nine districts of nearly equal area, and based on the records of 103 stations, was 10.2°, or 8.3° lower than the normal. The departures were marked throughout the State, being greatest in the northeastern district and least in the southeastern district. Seven stations reported a deficiency of 10.0°, or more, the greatest being 10.6° at Decorah and Postville, and the least was 6.4° at Keosauqua and Oakland. The highest mean for the state was 17.6°, at Keokuk, and the lowest was 3.8° at Lake Park. The absolute range for the state was 76°, from 47° at Sioux City on the 10th, to 29° below zero at Decorah on the 15th. Only three times in January has the range been less. The maximum for the state, 47°, was the lowest, with one exception in the history of the state. The average number of days with the minimum temperature zero or lower, was 18; minimum 32° or lower, 31; maximum 32°, or lower, 26; maximum zero, or lower, 1. The minimum was not above 32° at a single station during the entire month, and at three stations the temperature was above 32° on only 1 day.

Precipitation. The average precipitation for the State, derived from the averages of nine districts of nearly equal area, and based on the records of 112 stations, was 2.06 inches or 0.99 inch more than the normal. Only three other Januarys since 1873 have had more precipitation. The excess was least in the western portion of the State, and there were several stations that were deficient in precipitation; over the eastern and central portions the excess was an inch or more and quite uniform. The greatest amount reported from a single station was 4.10 inches at Burlington, and he least was 0.40 inch at Onawa. The greatest amount in 24 consecutive hours was 1.40 inches at Wever on the 22d. Days with 0.01 inch or more of precipitation, averaged 9, or 4 more than the normal, being greatest in the east-central district with 12, and least in the west-central and southwestern districts with 8. Only in 1916 has the average number of days with precipitation in January been greater.

Snowfall. The average snowfall for the State was 17.5 inches, or 10.8 inches more than the normal. This is the greatest January snowfall of record since statewide snowfall records began in 1892, though the records that are available for some stations indicate that the State average was probably greater in 1886. Only twice since 1892 has there been a greater average in any month, and both times the occurrence was in March. The average was the greatest, 23.5 inches, in the north-central and northeastern districts, and least, 11.1 inches, in the west-central district. The greatest amount reported from any station was 34.3 inches at Dubuque, and the least was 4.5 inches at Little Sioux. A number of stations in the eastern portion of the state reported the ground snow covered the entire month, and after the 4th the snow cover was continuous over almost the entire state.

Miscellaneous Phenomena. Aurora: 8th, 11th, 25th. Fog: 2d, 9th, 16th, 17th, 18th, 19th. Halos (lunar and solar): 1st, 2d, 4th, 5th, 6th, 7th, 10th, 11th, 15th, 18th, 19th, 20th, 21st, 22d, 23d, 25th, 26th, 30th, 31st. Haze: 19th. Sleet: 4th, 9th, 10th, 16th, 17th, 18th, 21st, 22d, 23d, 24th. Thunderstorms: 10th, 22d, 28th.

Rivers. Rather low stages prevailed on the Mississippi River at the beginning of the month but a marked rise set in at the end of the first week with rather high stages during the rest of the month, and the average stage was considerably above normal. The river was open most of the first week but with much floating ice and it froze rough. The thickness of ice ranged from 14 to 20 inches at the end of the month. The lowest stages on the Missouri also occurred during the first week and were

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.15	30.57	29	29.40	22	80	77	84	44	2	4,648	6.2	25	w.	22	47	— 2
Davenport	30.14	30.59	7	29.27	5	85	80	81	47	2	7,290	9.8	36	nw.	22	48	+ 1
Des Moines	30.15	30.62	31	29.46	22	88	74	80	47	1	5,236	7.0	25	nw.	11	47	— 1
Dubuque	30.13	30.57	4	29.36	5	79	68	78	34	7	4,408	5.9	23	nw.	11	42	— 7
Keokuk	30.16	30.65	7	29.37	18	80	65	76	39	20	5,690	7.6	30	nw.	11	48	— 3
Sioux City	30.18	30.63	31	29.45	17	87	78	80	53	10	8,534	11.5	51	nw.	22	42	—12
Omaha, Neb.	30.16	30.62	31	29.47	17	84	72	72	38	1	6,297	8.5	35	nw.	11	34	—22
Means and extremes	30.15	.....	.....	.....	.....	83	73	79	.....	.....	.....	8.1	.....	.....	.....	44	— 7
	.....	30.65	7	29.27	5	.....	.....	.....	34	7	.....	.....	51	nw.	22	.....	.....
Normals and records	30.14	.....	25th	.....	3d	84	.....	77	.....	19	.....	.....	.....	.....	6th	51	.....
	.....	¶31.00	1905	¶28.71	1906	.....	.....	.....	¶23	1928	.....	.....	¶58	nw.	1906	.....	.....

¶Sioux City. §Dubuque. ‡Local mean time. †And other dates.
‡‡January 1, 1928, 3-cup anemometers replaced the 4-cup instruments used since the establishment of the Weather Bureau stations. The new instruments will more accurately indicate the true wind movement. The records of the 4-cup instruments were somewhat too high at moderate velocities and considerably too high at the higher velocities. Tables of true velocities corresponding to indicated velocities appear in the January, 1928, Climatological Data. For purposes of comparison the highest velocity of record in the lower line of the table has been converted into a 3-cup velocity.

rather high during the rest of the month with slight fluctuations. The interior rivers were frozen generally after the latter part of the first week. There were some unimportant fluctuations due to ice conditions.

HEAVY SNOWFALL OF JANUARY, 1929

By H. Merrill Wills

Weather Bureau Office, Dubuque, Iowa

A new record has been set at Dubuque for all months by the heavy snowfall of January. The total fall of 34.3 inches is without precedent in the history of the station. The only previous monthly fall which approached this record was 32 inches in December, 1887. The heaviest single fall in 24 hours was 11.0 inches on the 4th-5th. This is the largest single snowfall in the last 17 years. The accumulated average depth at the close of the month amounted to 20.1 inches, and this appears to have exceeded all all previous records for the last 36 years, excepting one similar record of 20.5 inches in January, 1910. The snows of the last month have brought the winter's fall to date to 39.7 inches, which is more than a normal entire winter's fall. Practically the entire month's precipitation was from snow, amounting to 3.13 inches, which is the largest for January in 42 years.

The snows of the month were of unusual significance in the character of ground cover which resulted with its devastating effects upon street and highway transportation as well as damage to roofs and other property. Perhaps no snows have ever developed greater persistency in accumulating and hardening upon pavements, rendering the operation of vehicles difficult and dangerous at all times after the first heavy fall, on the 4th-5th. The conditions were decidedly aggravated along street car lines where the rails became deep channels or ruts in the heavy masses of frozen snow which covered the streets from 6 to 12 inches thick generally and as much as 18 inches thick in places. These conditions steadily grew worse and the city finally resorted to use of snow plows, tractors, scarifiers, graders, picks and trucks from the middle of the month on into February, in an effort to remove the snow and ice. The situation was somewhat improved when the month closed but still very bad generally.

More or less drifting occurred through the month which also interfered with street, highway and railroad transportation. The first heavy snow, on the 5th, drifted some, causing general delays and blocking country roads for several days. Street car service was paralyzed for a time, some lines not being able to resume operation for a day or two. Light to moderate snows fell at frequent intervals through the rest of the month, accompanied by considerable drifting which would refill where snow plows had removed the snow. Some interurban buses were unable to run at all during the rest of the month, especially north and east, due to blockades. Trains were frequently off schedule from one to several hours, and a 36-mile branch of one line was entirely closed for practically three weeks. Crews operating snow plows north of the city encountered drifts as deep as 10 feet. Colesburg, a small village about 30 miles northwest of Dubuque, was completely isolated for nearly three weeks. Snow plows operated vigorously day and night for practically a month in an effort to open the

roads throughout the territory around Dubuque, and to clear the streets in the city.

Of course, the persistent cold weather was a heavy contributing factor in that only slight melting of the snow occurred and this was immediately followed by freezing and consequent hardening of the snow, which made its removal extremely difficult. Again, on the 22d light rain formed an incrustation upon the snow and also encouraged the hardening of the whole cover, which retarded melting and evaporation later and increased the difficulty of removal.

It was believed a week ago that $200,000 would be a conservative estimate of the loss to business and damage to property resulting from the snows of January in Dubuque and surrounding territory. It has just now been announced that the roofing concerns of the city have placed an estimate of $100,000 upon the damage to property resulting from accumulated snow on the roofs, alone. Gigantic icicles measuring from 5 to 15 feet in length and as large as a man's body have been a common sight about the city and many can still be seen at this writing hanging from the eaves, the most of them having been removed by workmen to prevent possible injury to life and property.

FEBRUARY

Severe winter weather prevailed during the greater portion of February. The general characteristics were similar to those of January, though the changes were not so pronounced and the number of days with the temperature above normal were greater. The temperature extremes were greater than in January, but the cold was less severe due to the absence of strong winds during the coldest weather. Storms of a blizzard type were mild compared to those of January, but the lack of thawing in January, with the heavy snow in February, resulted in serious interruption to all modes of travel.

At the close of January the State was entirely covered with a blanket of snow, at places amounting to more than two feet, and with a rather heavy crust. During the greater part of the month the snowfall was light, but it was very dry, and with a light wind it moved so freely that all cuts through drifts were filled after every storm, and it required a constant effort to keep travel on the main highways and railways open, but at times it was necessary to suspend all traffic temporarily. No part of the State was free from drifts, and in many localities where conditions were favorable, there were drifts more than 15 feet deep. Efforts were made to keep only the main highways open, and practically all the less traveled roads were closed during the severe storm of January 4th-5th and continued so throughout February, except in a small strip in the southeastern portion of the State. Even on the main highways it was necessary to detour around some drifts that could not be kept open. Branch lines of railroads were forced to suspend operation many times during the month, and it was necessary to bring in supplies to small towns by sled. Rural mail delivery was almost impossible; some places had no mail for as much as two weeks; and all deliveries on rural routes were curtailed. The lack of adequate mail facilities was reflected in the enormous increase in the

use of long distance telephone service. The heaviest snow of the month occurred in the period from the 24th-26th and was sufficient to completely block all traffic for a time. It was necessary in one case to use three huge locomotives to move five cars and at a very slow rate. In the cities it was impossible to keep the streets clear; the snow on many streets became a solid mass of ice; and on many streets and highways there were only ruts through the snow where the automobiles traveled, and it was impossible to leave the ruts except at branch roads or intersections. In most cities all traffic was diverted to the cleared streets. Heavy hauling with chains did enormous damage to paving, and with the cost of snow removal added, the total cost of the heavy snows will amount to several million dollars. The accumulated snow caused many roofs to collapse and many more were damaged to such an extent that extensive replacement and repairs will be necessary.

While this winter does not rank as the coldest by a wide margin, the bad effects were intensified by the abnormally heavy snow, and this winter will be long remembered as unusually severe. The constant snow cover required that stock be kept on heavy feed at all times, and it was very difficult to haul hay to the stock sheds; birds that were not fed suffered further loss; and rabbits severely injured fruit trees and berry canes. No outside work, except that which was absolutely necessary, was attempted.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area and based on the records of 103 stations, was 14.0°, or 8.6° below normal. The departures were pronounced and uniform in all districts, with the greatest departure in the central district. The highest mean was 21.4° at Keokuk, and the lowest was 7.4° at Lake Park. The absolute range for the State was 87°, ranging from 52° at Keokuk on the 23d, to —35° at Decorah on the 20th. The average number of days with the minimum temperature 32°, or lower, was 28, though the minimum temperature remained above 32° at a few stations in the southern portion of the State on the 24th and 25th; the average number of days with the minimum temperature zero, or lower was 12, ranging from 14 in the north-central and northeastern districts to 10 in all southern districts. The greatest number of days with the minimum zero, or lower, was 16 in three districts and the least was 7 at one station in the southeastern district. The average number of days with the maximum temperature 32°, or lower was 22, ranging from 26 in the north-central district to 18 in the southeastern district. At 27 stations there were days on which the maximum temperature did not go above zero.

Precipitation. The average precipitation for the State, derived from the averages of 9 districts of nearly equal area and from the records of 113 stations, was 1.31 inches, or 0.10 inch more than the normal. There was an excess in all districts except the three eastern, the northeastern being exactly normal. Over most of the State the precipitation was all in the form of snow. The greatest amount at a single station was 3.03 inches at Iowa Falls and the least was 0.34 inch at Chariton. The greatest amount occurring in 24 consecutive hours was 1.43 inches at Red Oak on the 26th.

Snowfall. The average snowfall for the State was 12.5 inches, or 5.5 inches more than normal. This month ranks as the 2d greatest snowfall

in the period of Statewide snowfall records beginning in 1892. In 1905 the State average was 3.0 inches greater. The north-central district reported the greatest average with 18.7 inches and the southeastern the least with 4.8 inches. There was considerable melting in the southern and extreme eastern portions but over more than half of the State there was no melting and all the snow that fell during both January and February was still on the ground at the end of the month, though there was considerable settling. The greatest snowfall reported was 27.8 inches at Iowa Falls and the least was 1.1 inches at Keosauqua.

Miscellaneous Phenomena. Aurora: 21st, 26th, 27th, 28th. Fog: 11th, 13th, 20th, 21st, 23d, 24th, 25th, 27th, 28th. Halos (lunar and solar): 2d, 3d, 5th, 7th, 10th, 12th, 15th, 16th, 17th, 18th, 20th, 21st, 23d, 24th, 28th. Haze: 27th. Sleet: 24th, 25th, 26th. Thunderstorms: 7th.

Rivers. All rivers were frozen the entire month. Moderate stages prevailed and there was very little fluctuation, the extreme range on the larger streams averaged about one foot. On the interior streams low stages prevailed and there were falling stages most of the month.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	†A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.16	30.62	1	29.38	24	94	76	86	64	5	3,508	5.2	19	se.	20	45	—19
Davenport	30.15	30.69	1	29.34	26	89	76	80	50	20	5,489	8.2	30	sw.	26	58	+ 6
Des Moines	30.16	30.65	1	29.46	25	94	76	82	57	14	3,974	5.9	19	sw.	22	53	— 4
Dubuque	30.15	30.66	2	29.33	26	86	64	75	27	22	3,306	4.9	19	nw.	18	44	— 3
Keokuk	30.17	30.72	1	29.40	25	79	57	69	29	9	4,299	6.4	24	sw.	26	58	+ 5
Sioux City	30.17	30.63	1	29.60	16	87	81	84	48	15	6,538	9.7	32	w.	16	46	—11
Omaha, Neb.	30.16	30.61	1	29.58	25	83	70	74	45	22	5,136	7.6	26	nw.	17†	47	—11
Means and extremes	30.16	------	------	------	------	88	71	79	------	------	------	6.8	------	------	------	50	— 5
	------	30.72	1	29.33	26	------	------	------	27	22	------	------	32	w.	16	------	------
Normals and records	30.10	------	21st	------	28th	83	------	74	------	22d	------	------	------	------	4th	55	------
	------	§31.07	1918	*28.69	1902	------	------	------	¶13	1880	------	------	§56	nw.	1917	------	------

§Sioux City. *Davenport. ¶Des Moines. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

THE WINTER OF 1928-1929

The mean temperature for the three winter months was 17.6° which is 4.1° lower than the normal for the State, and 6.6° lower than the mean of 1927-1928. The average for the three winter months is the lowest since the winter of 1917-1918, which was 2.2° colder than this winter, and the low average was due largely in that winter to an abnormally cold December. Out of 56 winters for which Statewide average temperatures are available, 14 have been colder, the coldest being 1874-75, with a mean of 11.8°. The average temperature for January and February was the lowest since 1912, when the average was 11.2° compared to 12.1° in January and February, 1929. The highest temperature during the winter was 57° at Sioux City on the 27th of December, and the lowest was —35° at Decorah, on February 20th.

The average monthly precipitation for the State was 1.42 inches, and the average total was 4.26 inches, or 0.84 inch more than the normal. January precipitation was nearly double the normal, February was slightly above, and December was about 25 per cent below normal.

The average snowfall for the winter was 32.3 inches, which is 11.6 inches more than the normal, and only once since Statewide records of snowfall began in 1892, has there been a greater snowfall during these months, and never before has a greater amount been recorded in January and February. In contrast to this winter's heavy snow, the snowfall recorded in January and February, 1928, was the least ever recorded, and the total for the three winter months was the least, with the exception of the winter of 1921-1922.

The average number of days with 0.01 inch or more of precipitation, was 22, or 7 more than the winter of 1927-1928. The average number of clear days was 33, partly cloudy 20, and cloudy 37, as compared with 43 clear days, 21 partly cloudy and 27 cloudy days during the winter of 1927-1928.

MARCH

The severe winter conditions that prevailed during January and February broke early in March. The first six days of the month averaged slightly above normal and in portions of the State there was considerable thawing. A decided change to cooler occurred from the 7th to the 9th and thereafter until the 31st the temperature was above normal almost continuously. The last day of the month was cold, stormy and disagreeable. The mean temperature was about 0.2° warmer than last March and the average precipitation was exactly the same.

The outstanding feature of the month was the widespread floods that embraced practically the entire State. These floods began in the southern portion of the State during the last of the first week and at the end of the month places in the southeastern portion were still confronted with floods. The abnormally heavy snowfall of January and February had melted very little, except in the southern districts, and was still on the ground over the greater portion of the State. Before the principal floods occurred there were many serious situations produced by the formation of ice gorges that caused local floods for short intervals at many points in the southern portion of the State. Over most of the central and northern portions there was very little thawing until about the middle of the second week, although the snow had settled considerably. However, with the advent of mild weather a rapid thaw set in and by the middle of the third week there was very little snow left, except where drifted and in timber lands. The ground was frozen and could absorb very little water and this situation made conditions ideal for the production of floods and soon an unprecedented condition developed in many portions of the State. Never before, at any time, had there been as high stages on the Nishnabotna and Cedar rivers. The worst situation developed on the interior rivers, and practically all streams within the State overflowed at some part of their courses. The first serious flood developed on the Nishnabotna river,

and the situation was the worst in Fremont county. At the same time the Boyer river was also at flood stage, and the situation on both streams was aggravated by the formation of huge ice gorges that destroyed bridges, damaged highways, caused washouts and carried away farm property. The Raccoon river at Van Meter had been frozen continuously until the 11th, but with the rapid thawing a gorge formed that caused a rise to above flood stage overnight, and continued above flood stage for eight days, with a crest of 18.5 feet, just a few tenths less than the record stage. The Des Moines river did not reach flood stage at Des Moines, but it rose to slightly above 16 feet, and there was much apprehension as to the safety of the levees in the lower portions of the city, and constant watch was kept. Above Des Moines flood stages were reached at a few points as the result of gorges, but the timely use of dynamite prevented serious damage. Below Des Moines the flood situation was serious and much damage was sustained. At Tracy the river was above flood stage from the 12th to 23d and the crest exceeded the flood stage by 3.2 feet; at Ottumwa the crest was 4.5 feet above flood stage, and from the 14th until the 24th the stage was continuously at flood. Along the entire course of the stream thousands of acres were flooded, crops and small buildings washed away, and many people rendered temporarily homeless. The Cedar river experienced probably the worst condition. Floods were reported throughout its course, but the situation was the worst at Cedar Rapids and Waterloo. The crest stages were reported to have been the highest ever experienced at these points. The principal industrial plants were forced to suspend, business houses were flooded, and many homes abandoned. At many places power plants and water works were forced to suspend, and great inconvenience was experienced due to the lack of light and water. High water was also experienced in the Iowa, Maquoketa, Wapsipinicon and upper Iowa rivers, but by the manipulation of dams and use of dynamite at the proper times, the situation was kept well under control. The Mississippi did not reach flood stage above Muscatine, but the highest March stages of record were recorded. At Muscatine the flood stage was reached on the 19th, and at Keokuk on the 16th, and continued above flood stage throughout the rest of the month. Along the Mississippi River from Muscatine to Lee counties the levees remained intact, but it required constant effort, and there was some damage from seepage. The flood situation greatly interfered with train schedules, closed highway traffic at many places for extended periods, causing many industrial plants to suspend, and during the high water reduced the "head" at the Keokuk power plant to such an extent that less than 50 per cent of the normal power was produced.

On the 30th a storm set in that developed on the 31st into one of the most destructive ice and sleet storms. The northern portion of the State was generally affected, but the area of the greatest damage was in a stretch between Waterloo and Dubuque. Telephone poles were broken in great numbers, wires were weighted down with ice, and places were cut off from outside communication for several days; many places were without light or power.

The rapid thawing left the roads of the state in very bad condition. For a time the main highways were impassable, and as the snow and ice left the streets and paved roads great damage was disclosed. Where possible, preparation was made for seeding, but very little had been accomplished at the end of the month.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area and based on the records of 104 stations was 39.1° or 4.5° higher than the normal. The greatest excess occurred in the southeastern district, where the daily excess was 6.4°; in the east central district the excess was 6.1°; in the east central district the excess was 6.1°. In both these districts there was very little snow cover at the beginning of the month. The least departure was 3.3° in the central district. The greatest excess at any station was 7.3° at Davenport and the least departure was 1.2° at Iowa Falls and in this vicinity the snow remaining on the ground at the end of February was exceptionally heavy. The highest mean was 46.0° at Keokuk and the lowest was 33.6° at Northwood. The extreme range for the State was 88°, from 83° at Keosauqua on the 24th, to —5° at Mason City on the 9th. The average number of days on which the maximum temperature did not go above 32° was 2.5, ranging from 4 days in the northwestern district to 1 day in the southwestern and southeastern districts; at 12 stations the temperature was above 32° every day in the month. The average number of days with the minimum temperature 32°, or lower, was 19 ranging from 24 in the northwestern district to 13 in the southeastern district; zero occurred at 22 stations and at five of these places on two days.

Precipitation. The average precipitation for the State, derived from the averages of nine districts of nearly equal area, and based on the records of 117 stations, was 1.44 inches, or 0.33 inch less than the normal. The southeastern district had the greatest average, 2.89 inches, and this was the only district that reported an excess; the west-central district had the least average, 0.80 inch; all stations in the west-central, southwestern and south-central districts were deficient. The greatest amount reported from a single station was 4.92 inches at Wever and the least was 0.30 inch at Sac City. The greatest amount falling in 24 consecutive hours was 2.42 inches at Burlington on the 31st. The average number of rainy days was greatest in the southeastern district with 7, and least in the west-central, southwestern and south-central districts, with 3. At Carroll, Chariton, Mt. Ayr, Sac City and Tingley measurable precipitation occurred on but a single day while at Clinton and Fairport the number was 13.

Snowfall. The average snowfall for the State was 3.5 inches, or 1.9 inches less than normal. The greatest amount at a single station was 12.8 inches at Northwood. Thirteen stations reported no snowfall and nine only a trace. Most of the snowfall occurred during the storm of the 30th-31st, but locally heavy amounts occurred on the 1st, 4th and 12th. The greatest snowfall occurring during a single storm was 12.0 inches at Onawa on the 5th and Northwood on the 31st. The snow was mostly moist and did not drift badly. After thawing weather set in the snow disappeared rapidly but there were some drifts in timber that continued throughout the month.

Miscellaneous Phenomena. Aurora: 15th, 16th, 17th, 28th. Fog: 2d, 3d.

5th, 11th, 12th, 13th, 14th, 15th, 22d, 23d, 24th, 26th, 28th. Hail: 19th, 21st, 22d, 25th, 31st. Halos (lunar and solar): 7th, 14th, 18th, 19th, 20th, 27th. Haze: 10th, 27th, 28th, 30th. Rainbow: 2d. Sleet: 11th, 22d, 30th, 31st. Thunderstorms: 11th, 12th, 13th, 18th, 21st, 22d, 23d, 24th, 25th, 30th, 31st. Birds (migration of): Boone, blackbirds 13th. Earlham, robins 11th, blackbirds and bluebirds, 12th. Marathon, robins 13th. Postville, robins 12th, meadow larks 13th, blackbirds 14th. Oskaloosa, robins and bluebirds 8th, meadow larks 9th, blackbirds 20th.

Rivers. High stages prevailed on all rivers at times during the month and the average stages were considerably above normal. There was much fluctuation on the Missouri River but the extremes were not so pronounced as on the other streams. Ice conditions produced the most pronounced changes. On the Mississippi River nearly stationary stages prevailed during most of the first week and except for slight fluctuations there was a gradual rise till the end of the month, when the highest stages occurred. Flood conditions developed along the southeast border; at Keokuk the river was above flood stage during the last two weeks. The ice at Dubuque began breaking on the 14th but there was no general movement till the 15th and floating ice was present until the 19th. The average stage at Dubuque was 11.3 feet. This being the highest average stage ever experienced in March for a period of 60 years. The highest previous March stage was 9.0 feet in 1927. Navigation at Dubuque opened on the 20th. Flood stages were reached on nearly all interior streams at many points on their courses. The breaking of the ice in connection with the rapid melting of snow produced many gorges which carried away many railroad and highway bridges. Some of the streams were the highest ever known.

March Windstorms and Tornadoes. On March 24, about 10:00 P. M., a

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	29.91	30.69	9	29.17	6	87	69	74	36	28	5,330	7.2	28	nw.	6	47	—8
Davenport	29.91	30.63	9	29.20	6	82	68	68	31	27	8,679	11.8	50	nw.	6	61	+6
Des Moines	29.90	30.66	9	29.26	6	83	61	64	29	27	5,429	7.3	28	sw.	18	56	0
Dubuque	29.90	30.67	9	29.18	6	78	63	64	30	20	5,013	6.7	32	nw.	6	43	—16
Keokuk	29.93	30.66	9	29.31	6	78	54	60	29	7	5,788	7.8	34	w.	6	60	+2
Sioux City	29.90	30.67	9	29.23	22	79	61	61	18	26	9,165	12.3	51	nw.	6	58	0
Omaha, Neb.	29.90	30.65	9	29.25	22	74	54	55	9	27	5,864	7.9	34	nw.	6	56	—2
Means and extremes	29.91	30.69	9	29.17	6	80	61	63	9	27		8.7	51	nw.	6	54	—3
Normals and records	30.04	§30.82	29th 1921	*28.79	29th 1924	80	67	67	*5	18th 1918			§53	w.		57	

§Sioux City. *Des Moines. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

well defined tornado, with rotary winds and pendent, funnel-shaped cloud, moved from south to north, a distance of about three miles, in the north-central portion of Linn Township, Cedar County, where it damaged the buildings on five farms. The damage was estimated at $2,800.

On the same date, and at the same hour, a shifting windstorm, probably not of tornadic character, swept over Linn and Franklin townships, in Linn County, where it damaged farm buildings to the amount of $2,000. During the night of the same date a windstorm in Oxford Township, Jones County, caused damage amounting to about $500.

On March 31, at 3:15 P. M., large hail fell at Keokuk, Iowa, causing about $2,000 damage, mostly to greenhouses.

ICE STORM OF MARCH 31-APRIL 1, 1929

By H. Merrill Wills

(Weather Bureau Office, Dubuque, Iowa)

With the approach of an increasing storm from the southwest which passed northeastward one hundred and fifty miles south of the station, the barometer at Dubuque started falling about 10 P. M. of March 30th and continued to fall steadily until 11 P. M. of the 31st, Easter Sunday. The temperature all day Sunday remained within a few degrees of freezing. The wind continued steadily from the northeast with velocity ranging from 13 to 18 miles an hour, the fastest single mile being at the rate of 20 miles an hour.

Moist snow and rain began falling about 1 A . M. Sunday and continued, with small accretions of sleet at times, until 6:20 A. M. From 6:50 A. M. until near midnight rain fell almost incessantly, mixed with light amounts of sleet at intervals. Following this, there was a light fall of snow until 7:15 A. M. Monday.

Between 9 and 10 A. M. Sunday the rain began to freeze upon the ground, wires, limbs and the northeast side of all exposed upright objects. By evening the ice layer had reached a thickness of one-fourth to one-half inch upon wires, making an over-all diameter of one-half to one inch, in some instances more. In addition, there were millions of icicles suspended from the wires, about 2 inches long and 2 to 3 inches apart. The coating continued through Sunday night and until Monday noon, when it started falling from the wires and trees and by 6 P. M. had practically all disappeared.

The ice layer on ground was generally soft and did not result in any serious inconvenience, but the glaze on trees and wires caused widespread and severe damage to wire systems. Large branches of trees and in many instances large trees fell across the wires crushing them to the ground. Even where this did not occur the heavy weight of the ice, whipped by the wind, was sufficient to break down hundreds of poles, and destroyed communication in all directions.

The first trouble with wires began about 11 A. M. Sunday and developed rapidly thereafter. The city was completely isolated, so far as wire communication is concerned, from Sunday evening until about 10 A. M. Monday when the first connection was made with Minneapolis by telegraph. All telephone toll lines were out for several days and the supply of electricity

was cut off from several neighboring towns from one to two days. Local papers were without leased wire facilities for three or four days. Train dispatching equipment was crippled, causing delays in train service.

Telephone services suffered most heavily of any. In Dubuque County alone 500 telephones were put out of commission and 300 poles went down. In the three contiguous counties of Dubuque, Jo Daviess (Illinois) and Grant (Wisconsin), approximately 1,000 telephone, telegraph and electric supply poles were lost. It is considered one of the most devastating ice storms of record in this locality. While the damage to trees probably did not exceed a few thousand dollars in the territory mentioned, the total loss sustained by all properties including telephone, telegraph, and electric supply lines, has been estimated at $100,000. In addition, there was considerable loss to business due to the interruption in communication.

APRIL

The average temperature for April was more than two degrees above normal, due to an abnormally warm period 2d-8th, and the excess was quite uniform in all districts. During the rest of the month the temperature averaged below normal, with numerous fluctuations though no marked departures, and the general conditions were disagreeable. The chief feature relative to temperature conditions was the abnormally warm weather on the 4th. On this day July weather prevailed over almost the entire State, and a number of places reported the highest temperatures ever experienced at this time of the month. The high temperature at the beginning of the month advanced vegetation rapidly, and at some places in the southern portion of the State fruit buds opened prematurely but as no severe freezing occurred subsequently it is likely that no material damage resulted from frost. During the cool portion of the month most fruit buds remained dormant and at the end of the month apples were in bloom at only a few localities in the southern portion of the State. All tree fruit carried an enormous quantity of bloom. Cool, rainy weather prevailed during the blooming season of cherries, peaches and plums, and pollination was very likely imperfect. Due to unfavorable conditions, it is probable that there will be no unusual amount of fruit set. Bees suffered severely from winter killing and their absence even on warm days was marked. Vegetation, except grasses, made very little progress after the termination of the warm period.

There was a decided excess in precipitation, which amounted to nearly 60 per cent. The period October, 1928, to April, 1929, inclusive, was wetter than any similar period heretofore experienced in the history of the State, dating back 55 years. The total for the period was 17.81 inches, which exceeded the previous high total in 1918-1919 by 0.99 inch. The saturated condition of the soil permitted a large run-off and all streams were much higher than normal. Flood conditions were experienced on the Mississippi river from Muscatine southward most of the month, and along the southern border of the State the entire month. Small streams in the eastern portion of the State submerged a large amount of bottom land, and in sections it will be impossible to plant the usual crops. Industrial plants along the Mississippi river were seriously handicapped by seepage, which required

much pumping to avoid shutting down and prevent damage. The wet weather seriously interfered with farming operations in general. Much of the time it was impossible to work in the fields, and a large acreage that was intended for oats could not be seeded, and seeding in many instances was much delayed. The preparation of corn land was much delayed. Some corn had been planted on high ground at the end of the month, but almost without exception low lands were unfit to work the greater portion of the month. Even with favorable weather during the rest of the planting season, it is likely that it will be necessary to plant considerable early maturing corn and a larger amount of soybeans and catch crops than usual. Where conditions permitted, farm work was pushed as much as possible.

Travel on dirt roads was impossible most of the month, and on many of the main graveled highways travel was possible only by resorting to extensive planking.

Hail occurred on a large number of days but there were only a few localities where the damage was of consequence, consisting mainly of broken glass in greenhouses. Tornadoes occurred on four days, causing considerable damage to farm buildings in scattered localities.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of 104 stations, was 51.2°, or 2.3° higher than the normal. The greatest excess occurred in the east-central and southwestern districts and the least in the north-central, northeastern and west-central districts. The greatest excess of any station was 4.2° at Corning and the least was 0.4° at Logan. The highest mean was 54.6° at Keokuk, No. 2 and Thurman, and the lowest was 47.0° at Lake Park. The monthly range for the State was 84°, the highest temperature being 93° at Little Sioux on the 4th and the lowest was 9° at Inwood on the 1st. With but a single exception the highest and lowest temperatures occurred during the first week. The average number of days with the minimum 32° or lower was 6, ranging from 8 in the northwestern and north-central districts to 3 in the southeastern district. Temperatures of 90°, or higher occurred at 13 stations, 5 in the west-central district and all in the southwestern. No temperature records were broken for the month but a number of stations in the western portion of the state reported the highest on the 4th for that early in the season.

Precipitation. The average precipitation for the State, derived from the averages of nine districts of nearly equal area and based on the records of 117 stations was 4.62 inches, or 1.66 inches greater than the normal. The southeastern district reported the greatest average, 6.30 inches, and the northwestern the least, 3.16 inches. There was an excess in all districts though deficiencies occurred at a number of stations in four districts, the only area of consequence being in the northwestern district. The greatest amount reported from any station was 7.97 inches at Muscatine and the least was 1.81 inches at Sioux Center. The greatest amount falling in 24 consecutive hours was 3.01 inches at Keosauqua on the 19th. The average number of days with 0.01 inch or more of precipitation was 11, ranging from 8 in the northwestern district to 13 in the three southern districts. For individual stations the range was from 6 days at Algona, Alton and

Sac City to 18 at Stockport. The rainfall for the month was notably heavy, there being but five times heretofore when a greater amount occurred in April.

Snowfall. The average snowfall for the State was 1.1 inches, or 0.8 inch less than the normal. The greatest amount reported from any station was 15.0 inches at Estherville; more than half of the total number of stations reported no snowfall, or only a trace. The snowfall was moist and a great deal melted as it fell. The heaviest snow was confined to the extreme northern portion of the state.

Miscellaneous Phenomena. Fog. 4th, 14th, 16th, 17th, 18th, 19th, 20th. Hail: 5th, 6th, 7th, 10th, 16th, 17th, 20th, 23d, 24th, 25th, 27th, 28th, 30th. Halos (lunar and solar): 1st, 3d, 13th, 14th, 18th, 21st, 22d, 27th. Haze: 4th, 5th, 15th. Rainbow: 24th, 29th. Sleet: 1st, 9th, 10th. Thunderstorms: 1st, 4th, 5th, 6th, 7th, 10th, 11th, 16th, 19th, 20th, 23d, 24th, 25th, 27th, 28th, 29th, 30th. Tornadoes: 5th, 6th, 27th, 30th. Winds (high): 5th, 6th, 7th, 24th, 30th.

Rivers. High stages prevailed on all streams but flood stages were not experienced except on the Mississippi from Muscatine to Keokuk and on the Des Moines from Ottumwa to the Mississippi. At Muscatine the river was at flood stage 21 days during the month and at Keokuk during the entire month, making a period of more than six weeks that the river was continuously above flood stage since flood stage was passed about the middle of March. At the end of the month nearly all streams were falling and on several streams the lowest stages for the month were recorded on the last day.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon†	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	29.89	30.30	22	29.35	25	79	59	65	27	22	4,845	6.7	27	sw.	5	57	— 1
Davenport	29.88	30.29	22	29.26	25	79	62	64	37	2	8,932	12.4	41	w.	27	66	+ 9
Des Moines	29.86	30.31	22	29.28	25	79	56	58	27	22	5,872	8.2	32	sw.	5	53	— 6
Dubuque	29.88	30.29	22	29.29	25	72	54	60	26	22	4,718	6.6	24	n.	26	54	— 3
Keokuk	29.90	30.31	2	29.27	25	73	54	58	24	2	6,110	8.5	31	nw.	1	50	— 7
Sioux City	29.87	30.27	22	29.17	5	81	56	50	14	5	8,413	11.7	49	sw.	5	59	+ 3
Omaha, Neb	29.86	30.28	22	29.34	24	76	50	52	19	16	5,698	7.9	34	n.	25	55	— 4
Means and extremes	29.88	----	----	----	----	77	56	58	----	----	----	8.9	----	----	----	56	— 1
	----	30.31	2†	29.17	5	----	----	----	14	5	----	----	49	sw.	5	----	----
Normals and records	29.98	----	9th	----	20th	76	----	57	----	25†	----	----	----	----	25th	57	----
	----	§30.78	1918	*28.90	1898	----	----	----	¶10	1902	----	----	¶60	n.	1902	----	----

§Dubuque. *Davenport. ¶Sioux City. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

MAY

The chief characteristic of the weather during May, 1929, was the persistent cool weather that prevailed until the middle of the fourth week. The first and third weeks were the coldest; the second week was below normal, though there were several days that averaged slightly above normal. The temperature for the first three weeks averaged about six degrees below normal but the last week was warm and brought the average daily deficiency for the State to 2.4°. There was a decided change to cooler on the 15th-16th, the drop in temperature amounting to 40°, or more, during a 12-hour period at a number of stations. Frost occurred frequently during the first two weeks over most of the State, and as late as the 21st over most of the northern portion, but owing to the backward stage of vegetation there was not a great deal of damage. The principal damage occurred to strawberries, grape buds and tender plants that were set out and not sufficiently hardened. As the frosts continued the vegetation developed frost resisting properties and some of the most severe freezes did practically no damage. The first strawberry blooms were practically all killed but there was a large amount of bloom later and a large quantity of fruit set. Tree fruit fell off badly and many plum and cherry trees that carried great quantities of bloom were found to be entirely fruitless.

The average precipitation was slightly more than half of the normal for the month, and only a few stations reported a slight excess. The first general precipitation period occurred on the 10th-11th and rather heavy falls occurred at a large number of stations and some local damage resulted. During the rest of the month showers occurred at frequent intervals but no general rains of consequence occurred until the 28th-29th. A large number of places reported damaging rains but the greatest damage occurred over an area from Woodbury to Lyon counties, which consisted of bridges being washed away, washouts on railways and highways, bottomlands overflowed, and some farm animals drowned. Traffic on motor busses was temporarily suspended and railway traffic was held up as much as 24 hours. There was some damage from wind, hail and tornadoes.

Farm operations were much behind at the beginning of the month but favorable conditions as to moisture permitted work to be pushed, and at the close of the month conditions compared favorably with the average season. However, a large amount of overflowed land was still too wet at the end of the month to work and cannot be planted to the usual crops. The weather was too cool for the growth of corn and some fields showed yellow; winter wheat, meadows and pastures were generally in good condition and made good growth. Sunshine was normal, and with a good wind movement conditions were favorable for the cultivation of all crops, and weeds were well under control.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of 103 stations, was 57.7°, or 2.4° lower than the normal. There was a deficiency at all stations with considerable range for individual stations. The deficiency was least in the northwestern district and greatest in the northeastern district. The highest monthly mean was 61.1° at Burlington

and the lowest was 52.3° at Postville. The absolute range for the State was 67°, ranging from 91° at Davenport No. 2 on the 28th and 29th and at Mt. Pleasant on the 31st, to 24° at Inwood on the 2d and 16th, Sanborn on the 5th and Webster City on the 7th. Temperatures of 90°, or higher occurred in but three districts and at but nine stations. The average number of stations with the minimum temperature 32°, or lower was 4, ranging from 7 in the north-central and northeastern districts to 1 in the southeastern district; the greatest number at any station was 9 at two stations and at nine stations the temperature did not reach 32°.

Precipitation. The average precipitation for the State, derived from the averages of nine divisions of nearly equal area and based on the records of 117 stations, was 2.47 inches or 2.11 inches less than the normal. The average was exactly the same as last May. The deficiency was general throughout the State and only five stations reported an excess, all being less than one inch. Very little precipitation occurred during the first week, but during the rest of the month showers occurred at frequent intervals though, as a rule, they were light. The heaviest rains over most of the State occurred on the 10th-11th, and over the northwestern portion on the 28th-29th. The greatest amount reported from a single station was 5.79 inches at Riverton, and the least was 0.82 inch at Chariton. The greatest amount occurring in 24 consecutive hours was 4.03 inches at Hawarden on the 28th-29th.

Snowfall. No appreciable snowfall occurred during the month and only a few stations reported traces.

Miscellaneous Phenomena. Fog: 14th, 21st. Frost: 1st, 2d, 3d, 4th, 5th, 7th, 9th, 12th, 15th, 16th, 19th, 21st. Hail: 11th, 15th, 19th, 23d, 28th, 29th. Halos (lunar and solar): 4th, 8th, 9th, 12th, 13th, 16th, 17th, 18th, 21st, 30th, 31st. Haze: 23d. Rainbow: 12th, 28th, 29th. Sleet: 20th.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.05	30.49	9	29.55	1	74	51	53	19	9	4,562	6.1	30	n.	1	61	—1
Davenport	30.05	30.47	9	29.49	1	77	62	62	37	22	6,892	9.3	33	nw.	15	68	+6
Des Moines	30.03	30.50	9	29.53	1	78	50	51	27	4	5,055	6.8	20	sw.	22§	58	—4
Dubuque	30.05	30.49	9	29.51	1	72	48	51	21	21	4,908	5.8	23	ne.	2	66	+8
Keokuk	30.06	30.47	9	29.55	1	73	56	59	29	5†	4,643	6.2	25	sw.	11	58	—16
Sioux City	30.03	30.49	9	29.60	26	76	49	47	27	6	8,030	10.8	37	nw.	15	71	+11
Omaha, Neb	30.02	30.44	9	29.63	26	73	50	52	21	2	5,906	7.1	30	n.	1¶	59	—2
Means and extremes	30.04					75	52	53				7.4				62	0
		30.50	9	29.49	1				19	9			37	nw.	15		
Normals and records	29.95		4th		‖17	77		59		3d					1st	62	
		*30.58	1910	§29.02	1875				§10	1889			¶67	nw.	1894		

*Dubuque. §Omaha. ‖Also Sioux City 9th, 1927. ¶Sioux City. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

Thunderstorms: 4th, 10th, 11th, 13th, 14th, 15th, 17th, 19th, 20th, 23d, 25th, 26th, 28th, 29th. Tornado: 28th.

Rivers. There was a continuous fall on the Mississippi River throughout the entire month. The mean for the month was slightly above normal, but stages were below normal at the end of the month; a general falling tendency prevailed on the principal interior streams but there were some fluctuations after the middle of the month. On the Missouri River falling stages prevailed during the greater portion of the month, though there were numerous slight fluctuations throughout the month. A rise occurred during the last week with the highest stages for the month on the last day.

JUNE

June, 1929, averaged below normal, it being the fourth month of the current year that has been deficient in temperature, though the deficiency was less than any other month. Most of the deficiency was due to a rather protracted cool period extending from the 1st to the 8th. Cool weather also prevailed on the 12th and 13th and during most of the fourth week; the principal warm period extended from the 15th to 19th, though the warmest day occurred generally on the 10th, 29th or 30th. There was no unseasonably warm weather during the entire month and on the warmest days the humidity was generally low and for the entire month it was considerably below normal.

The average precipitation was slightly in excess of two-thirds of the normal, and in a large portion of the State the amounts were less than one-half of the normal. There was an excess along the border in the western, southern and eastern portions of the State. The principal excess occurred in Woodbury County and a small surrounding area; the other areas extended in a norrow strip from Page County eastward and along the Mississippi River northward to Dubuque County, except portions of Louisa and Muscatine counties. The rainfall was very unevenly distributed and there was a wide range in the amounts and time of occurrence, the number of days with appreciable rainfall ranging from four to eighteen. A large per cent of the rainfall occurred in the form of heavy downpours and drouthy conditions developed in a large portion of the central and north-central districts. As a rule, the downpours were accompanied by other damaging conditions consisting of wind, hail, lightning and floods over limited areas, and one tornado was reported. Storms of a damaging nature occurred on eleven days in some parts of the State, and on the 11th, 16th, 27th and 30th the damage was severe. The storm of the 11th affected most of the northern half of the State and a small area in the southeastern district. The damage resulted from hail, wind and floods in small streams. The extreme northwestern portion of the State was the hardest hit by this storm and the crop damage in Sioux and Lyon counties amounted to about $1,000,000. The next storm of consequence occurred on the 16th and the area of greatest damage occurred from Monona to Sioux counties. In addition to severe hail and wind, this storm was accompanied by excessive downpours and severe damage from floods over much of the area. Many business houses had flooded basements and also dwellings were inundated, and after the water receded there was left a heavy deposit

of mud. The hail in this storm was unusually severe. The stones were large and broke many windows, beat roofs to pieces, stripped houses of spouting, and ruined automobile tops. The damage in Monona and Woodbury counties amounted to more than $750,000. On the 27th, wind and hail caused damage in a strip running from Carroll to Story counties, and a large area in the northeastern portion of the State, the greatest damage being in Clayton and Dubuque counties. On the last day of the month storms were active in the west-central and east-central portions of the State. In the west the greatest damage came from hail, and in the east strong gusts of wind blew down poles and trees and damaged small buildings.

The condition of the principal crops was satisfactory even in the portions of the State where the rainfall was light, as there seemed to be an abundance of subsoil moisture. Corn was very uneven in size, ranging at the close of the month from too tall to cultivate to two inches. It was most backward in some south-central and southwest counties where continued wet soil delayed planting, but the average condition was good and cultivation had progressed satisfactorily; pastures were good and rank in some portions of the State; hay promised well though there was some damage from rain; in portions of the State the strawberry crop was cut short by dry weather; potato and truck crops were promising.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of 101 stations, was 67.6°, or 1.7° lower than the normal. All stations reported a deficiency and the range of the deficiency in the several districts was less than usual. The highest monthly mean was 70.7° at Thurman, and the lowest was 62.8° at Postville. The absolute range for the State was 61°, from 99° at Guthrie Center on the 30th, to 38° at Fairfield, Fayette, Olin, Pocahontas, Postville, Sanborn and Williamsburg on the 3d, and Washta on the 13th. The average number of days with the temperature 90° or higher, was 2. The number ranging from 7 at three stations to none at 15. The southwestern district had the greatest number 5, and the north-central and northeastern 1.

Precipitation. The average precipitation for the State, derived from the means of nine districts of nearly equal area, and based on the records of 116 stations, was 3.08 inches, or 1.42 inches less than the normal. There was a deficiency in each district, being least in the southeastern district where the deficiency amounted to about one-third of an inch, and greatest in the north-central and central districts, where the deficiency was marked. The heaviest rains during the month were not general. On the 1st and 2d heavy to excessive rain occurred over most of the southern half of the State, and none over most of the northern half. On the 6th-7th heavy rains were general over most of the western portion of the State. Heavy rains occurred over most of the State on the 11th-12th, 17th-18th and 26th-27th. A few locally heavy rains occurred on other dates in very limited areas. The rain periods were frequent but the amounts varied greatly. Sioux City reported the greatest June Rainfall of record, while two stations reported an inch, or less, and conditions were drouthy over large areas

in the central, north-central and northeastern districts. The greatest monthly amount was 8.47 inches at Sioux City, and he least was 0.82 inch at Toledo. The greatest amount in 24 consecutive hours was 4.61 inches at Keosauqua on the 1st.

Miscellaneous Phenomena. Fog: 5th, 13th, 23d, 29th. Hail: 11th, 12th, 13th, 16th, 17th, 22d, 26th, 27th, 28th, 30th. Halos (lunar and solar): 3d, 6th, 16th, 21st, 26th. Rainbow: 4th, 27th. Thunderstorms: All dates except 3d, 5th, 8th, 9th, 10th, 20th, 25th, 28th. Tornado: 11th.

Rivers. Except for a slight rise near the middle of the month there was a gradual fall on the Mississippi River throughout the month, with the average stage considerably below normal. There was considerable fluctuation on the Missouri River though no marked changes. The stage averaged below normal at Sioux City and above at Omaha. A general falling tendency prevailed on the principal streams in the interior of the State but there were a few slight rises with the average stage below normal. Heavy rains in northwestern Iowa on the 16th caused floods in Woodbury County and small adjacent areas.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	29.94	30.32	3	29.52	11	76	51	56	25	23	3,777	5.2	26	se.	16	61	— 7
Davenport	29.94	30.26	3	29.57	11	74	53	53	30	5	5,907	8.2	35	nw.	11	70	+ 1
Des Moines	29.92	30.28	3	29.52	11	78	53	53	27	5	4,686	6.5	23	sw.	17†	71	+ 5
Dubuque	29.94	30.29	3	29.52	27	74	52	54	26	6	3,702	5.1	24	nw.	27	65	+ 1
Keokuk	29.96	30.24	3	29.52	11	76	54	58	30	5	4,472	6.2	29	s.	17	69	— 3
Sioux City	29.91	30.29	3	29.44	11	73	58	55	29	27	6,906	9.7	47	nw.	11	69	— 3
Omaha, Neb.	29.91	30.24	3	30.49	11	74	50	49	25	20†	4,734	6.6	26	ne.	21†	69	+ 1
Means and extremes	29.90	30.32	3	29.44	11	75	53	54	25	20†		6.9	47	nw.	11	66	— 1
Normals and records	29.90	*30.61	10 1913	§29.04	5th 1880	79	60	60	¶13	7 1926			568	w.	22 1917	67	

*Dubuque. §Omaha. ¶Sioux City. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

JULY

The temperature during July averaged 0.4° above normal. The first three weeks were cool, with a large number of fluctuations, but the rest of the month, excepting the 29th and 30th, in the western and central portions, was continuously above normal. The week 22d to 28th was the warmest of the year. The month was more pleasant than the average July, due to the fact that during the warmest weather the humidity was low, and very few nights could be classed as hot. Heat prostrations were few. There were no great extremes in temperature; the highest observed

temperature was well below the average for July, and except at two stations no unusually low minima occurred.

The average precipitation for the State also averaged slightly more than the normal, but the amounts showed great variation. The first half of the month was decidedly wet, and during this period more than 75% of the total occurred. A number of stations in the south-central, southeastern, east-central and northwestern districts, reported no appreciable rainfall after the 15th. The storm damage was less than usual for July, but a large portion of the State was affected. The main damage was caused by wind squalls and hail. Strong winds accompanied nearly all the heavy rains, and local damage was reported from a large number of places; hail damage was mostly in small patches and no exceptionally heavy losses occurred. Much of the rainfall occurred as heavy downpours, which caused small streams to overflow and considerable grain in the shock was either washed away or ruined by being wet. The worst floods occurred in the extreme southwestern portion of the state following the heavy rains of the 5th, and the greatest damage occurred in Page County, which included damage to corn and shocked or stacked grain, the washing out of 17 bridges, and submerged railway tracks; and many automobiles attempting to reach points of safety were stalled. On some of the branch line railways traffic was suspended for more than three days. The almost continuous rainfall during the first half of the month interfered very much with farm operations, damaged a large amount of hay and grain in the fields, and many corn fields in the eastern and southern portions became weedy. The latter part of the month was more favorable. The warm weather caused corn to make rapid growth where moisture was sufficient, and hay was harvested under good conditions; however, the dry weather was beginning to affect many truck crops in the dry areas, some pastures were becoming brown and bare, and in some localities corn leaves rolled in the afternoons, and some firing was reported.

One tornado was reported during the month. It occurred in Cedar County, in the eastern portion of Dayton Township, and touched a part of three sections. Owing to the short distance traveled and the absence of buildings very little damage resulted. Lightning caused the death of two people, one in Des Moines and the other in Delaware County. There was considerable loss to stock from lightning and from being drowned.

Three meteors, out of the ordinary class, were noted. The brilliant one about 9:46 p. m. of July 25, attracted much attention, and reports of it were received from more than 100 persons in all sections of Iowa. Observers as near to the meteor as extreme eastern Iowa and in the country, free from other sounds, heard no sound in connection with the meteor. It was visible only a few seconds. It resembled a sky rocket and made sufficient light to cast shadows in the eastern half of Iowa and to enable one to read large newspaper print at the Mississippi River. Many observers reported that it was of "blinding brilliancy." A preliminary report by Prof. C. C. Wylie of the State University at Iowa City appears elsewhere in this issue.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of

106 stations, was 74.1°, or 0.4° higher than the normal. There was an excess in all divisions except the central which was 0.6° below normal and the southeastern which was exactly normal. The greatest excess was in the northwestern district with an excess of 1.2°. There were one or more stations in every district that showed a deficiency. The highest monthly mean was 77.0° at Keokuk and the lowest was 70.6° at Postville. The absolute range for the State was 55°, from 98° at Afton and Lenox on the 31st, to 43° at Maquoketa and Waukee on the 20th. The average number of days with the maximum temperature 90°, or higher, was 8. The greatest average by districts was 9 in the northwestern, east-central and southwestern and the least was 6 in the central district. The greatest number at a single station was 15 and the least was 2.

Precipitation. The average precipitation for the State, derived from the average of nine districts of nearly equal area, and based on the records of 120 stations, was 4.31 inches, or 0.48 inch more than the normal. There was a deficiency in the three northern districts and an excess in all other districts, though there were stations in the deficient area that showed an excess and one or more stations in each district that had an excess, showed a deficiency. At a large number of stations most of the monthly total occurred during a single shower period and local floods occurred at several places. The average number of rainy days was nine, being greatest in the southeastern district with an average of eleven days, and least in the northwestern district with an average of six. For individual stations the range was from fifteen to two. The greatest amount from a single station was 12.30 at Riverton, and the least was 1.47 inches at Dubuque. The greatest amount occurring in 24 consecutive hours was 4.25 inches at Clarinda on the 6th.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.00	30.24	14	29.64	6	79	51	58	25	28†	3,681	4.9	17	sw.	3	69	— 6
Davenport	30.00	30.27	20	29.70	4	78	54	57	23	28	4,752	6.4	48	nw.	8	73	+ 1
Des Moines	29.98	30.22	10	29.67	6	80	58	59	22	28	4,141	5.6	22	sw.	31†	60	—13
Dubuque	30.00	30.30	20	29.63	4	75	49	55	26	28†	3,519	4.7	24	s.	8	68	— 2
Keokuk	30.03	30.26	20	29.77	6	77	55	61	29	29	3,579	4.8	24	sw.	6	65	—12
Sioux City	29.97	30.20	19	29.61	27	81	57	57	30	28	6,729	9.0	32	sw.	23	72	0
Omaha, Neb.	29.98	30.19	9	29.70	6	76	54	56	24	28	4,089	5.5	21	nw.	14	64	—11
Means and extremes	29.99	30.30	20	29.61	27	78	54	58	22	28		5.8	48	nw.	8	67	— 6
Normals and records	29.97	*30.47	7th 1892	§29.29	9th 1926	79	57	¶13	25th 1894				52	ne.	13th 1905	73	

*Davenport. §Sioux City. ¶Des Moines. ‖Omaha. ‡Local mean time. †And other dates.

‡‡See footnote under similar table at end of January.

Miscellaneous Phenomena. Fog: 1st, 7th, 15th, 16th, 17th, 18th, 31st. Hail: 3d, 4th, 5th, 6th, 8th, 11th, 13th, 14th, 23d, 31st. Halos (lunar and solar): 3d, 7th, 10th, 12th, 19th, 20th, 23d, 30th. Haze: 10th, 16th. Meteors: 9th, 25th, 27th. Rainbow: 6th, 8th, 10th. Thunderstorms: All dates except 2d, 5th, 9th, 10th, 16th, 17th, 18th, 19th, 26th, 27th, 29th. Tornado: 6th.

Rivers. The average stage of all the principal rivers was below normal. The principal rises on the Mississippi River occurred during the latter part of the 1st and 2nd weeks; thereafter the tendency was to lower stages though there were slight fluctuations with the lowest stages near the end of the month. On the Missouri River there was a general falling tendency through the month except for a slight rise during the 2d week. The highest stages occurred on the 1st and the lowest on the last of the month. Low stages prevailed on most of the larger streams in the interior of the State with falling stages most of the time and no important fluctuations. The only floods of consequences occurred in the smaller rivers in the southwestern portion of the State.

THE METEOR OF JULY 25, 1929

C. C. Wylie, University of Iowa

This meteor, which fell at 9:46 P. M., central standard time, has been reported from O'Neill, Nebraska, west, and Cottonwood, Minnesota, northwest, to Detroit, Michigan, east, and Marissa, Illinois, south. (See map for locations of Cottonwood and Marissa.) The reports from west and northwest were collected in Sioux City by the Weather Bureau, and are evidently observations of this meteor. Information has been received from the states of Illinois, Indiana, Iowa, Michigan, Missouri, Minnesota, Nebraska, Wisconsin, and South Dakota. This by no means represents the area over which it was visible. Rather it represents the area over which Mr. Reed and the Department of Astronomy at the University of Iowa can collect information in a short time. If we assume that the meteor was seen as far in other directions as it has been reported to the west and northwest, and it should have been with proper weather conditions, it was seen also in Alabama, Arkansas, Canada, Georgia, Kansas, Kentucky, Maryland, Mississippi, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. It lighted up nearly a million square miles of territory, a remarkable record.

Because of its great brilliancy, it gave the majority of observers the impression of being quite close. At the Yerkes Observatory, William Bay, Wisconsin, astronomers of long experience started to dodge when they saw the brilliant meteor coming directly toward them, although it seems to have disappeared at a distance from them of about fifty miles. Near Milwaukee, coast guard men on the edge of Lake Michigan thought they saw a "flaming ariplane diving into the lake." Even in Nebraska a group was sitting in an unlighted room when "the whole house was lighted up with such an intense bright red light, and all exclaimed at once, 'What was that?" Our first thought was that it was the ligh from a car thrown just right"; and from that same state, careful reports include such items as that the observer's impression was that the meteor must have fallen within half or three-quarters of a mile of where he was standing. Many

letters from Iowa and eastern Illinois contain such expressions as "it fell directly east of us, seemed to be just across the road."

Whether any meteorites reached the surface of the earth we cannot say as yet. The bright meteor itself came low enough, about twenty-four miles, that it appears possible for meteorites to have fallen from there to the surface of the earth. Meteorites fall through our lower atmosphere as dark bodies, not as balls of fire, and as this fall occurred at night they could not have been seen. In our opinion, nothing larger than ten or fifteen pound stones reached the surface of the earth, and as several square miles of territory must be searched, their recovery will be problematical. However, Professor C. P. Oliver of the University of Pennsylvania, President of the American Meteor Society, writes us, "I have hopes that pieces may be recovered."

The letters show that a few other bright meteors were seen that evening, which is not unusual in late July. For example, Mr. Fred E. Allender, of Davenport, sends a sketch of the path of one observed at 11:25 P. M., which was probably brighter than Venus, but we have gotten no other reports of that particular object. The evidence at hand indicates that only one meteor of great brilliancy was seen that evening.

The large arrow on the accompanying map shows the path in our atmosphere, the figures beside the arrow being the height in miles above the surface of the earth. The path was computed from two sets of observations; first, those of the astronomers at the Yerkes Observatory as communicated by letter; and second, from the altitude and azimuth of points of appearance and disappearance for certain places in eastern Iowa. These were determined by having an experienced person interview the observer at the exact place from which the meteor was seen, and read the angles from a transit pointed in the direction indicated.

The short arrow in southern Wisconsin shows the path of a meteor a little brighter than Venus as viewed from Iowa. This path was computed from observations made only in the state of Iowa. It fell at 9:34 P. M. on the evening of June 25.

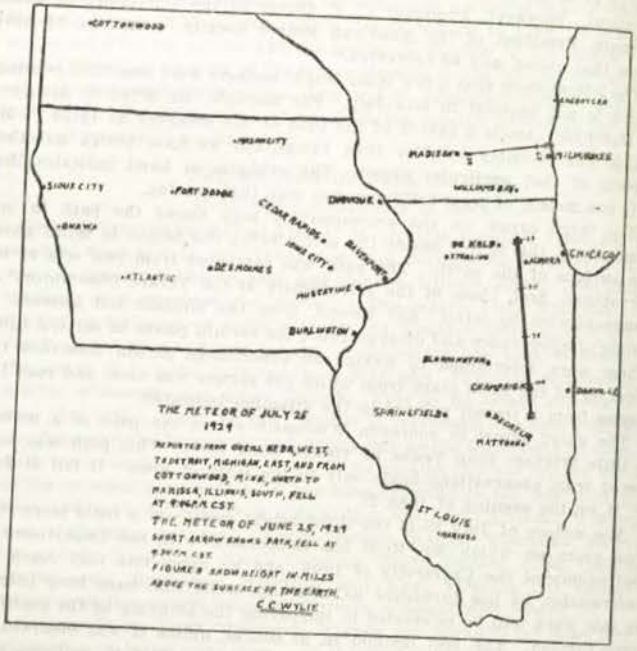
The meteor of July 25 is the third bright meteor in a little more than two years on which Mr. Reed has co-operated with the Department of Astronomy at the University of Iowa, and we appreciate very much the information he has furnished us. Perhaps some who have been helping in this work will be interested in improving the accuracy of the positions they furnish. The best method is, of course, unless it was observed by one familiar with the constellations, to enlist the aid of an engineer, take him with you to the place the meteor was observed, and let him read with a transit the altitudes and azimuths for the points at which the meteor was first seen and last seen. Another method, used by experienced persons when no transit is available, is illustrated by measures furnished by Miss Ruth Berry of Toulon, Illinois. Standing where she saw the meteor, she pointed a yard stick toward the place of disappearance, and a friend measured the east end of the yard stick as 8 inches above and 22½ inches north of the west end. She then pointed toward the place where she had first seen it, and found the east end measured 18 inches above and 22½ inches south of the west end. From these simple measurs, which can

obviously be made very easily, an astronomer can quickly compute the altitude and azimuth.

SOUND OF METEORS

In connection with the meteor of July 25, several persons reported sounds, but the lack of agreement and other circumstances indicates that the sounds reported came from other sources than the meteor.

Sound travels only about a mile in 5 seconds, so if a meteor were 50 miles from an observer, he would not hear any sound, if there be sound,



till more than four minutes after the disappearance of the meteor. It is doubtful if any sound produced by a meteor could be heard 100 miles, but if it could it would take nearly 10 minutes for the sound to reach the observer. So observers should listen carefully for sounds for at least 10 minutes. Sounds made by the recent meteor at the instant of its disappearance, at a height of 24 miles, would not have been heard by persons directly below till approximately two minutes afterward. Isolated country locations are best for observations of sound.

AUGUST

The average temperature for August 1929, was but 0.2° above the normal, but there was a marked contrast between the eastern and western portions. The eastern portion, except a small area in the northeastern district, was considerably below normal, while over the western half there was an excess. The weather during the month was noticeably changeable. The first half of the month was the colder, and the coldest weather generally occurred during the latter part of the first week and at the end of the second week and the beginning of the third week. A rather warm period prevailed from the 21st to the 26th, with the temperature 90° or higher on several days. The warmest periods were somewhat tempered by low humidity, and there was less suffering by both man and beast than is usually experienced in August.

The most outstanding feature in connection with the month's weather was the torrential rain storm that occurred during the night of the 1st-2nd. The heavy rain covered an area reaching from the north-central district, southeastward over the east-central district, the area of heaviest rainfall being in a rather narrow strip from Hardin County to Cedar County. The greatest fall, 8.27 inches, occurred in Tama County, at Toledo, from 11:00 P. M. of the 1st to 6:00 A. M. of the 2nd. Most of this amount fell within a period of about two hours, and it is probable that this was the heaviest rainfall ever experienced in the state for such a short time. This unusual downpour caused a rapid rise in the Iowa River and its tributaries; some localities reported the highest stream stages ever known. As a result of the unexpected rise, there were large property losses and many dwellings, both in towns and rural localities, were flooded. The property losses consisted of highway and railway bridges washed away, stretches of track washed out, highways damaged, and much shocked grain carried away and farm animals drowned. Miles of railway were under water and many trains had to be detoured or suspended temporarily.

The rainfall averaged 1.00 inch below the normal, but as much of the rain fell in short periods, the effective rainfall for the State was much less than the departure indicates. The area of heaviest rainfall had very little rain after the 2d, and this area as well as the greater portion of the State, was injured somewhat by drouth at some time during the month. Crops suffered considerably in much of the state, particularly in the southwestern and west-central districts; corn fired badly in many fields, the output of commercial canneries was greatly reduced, and gardens in many places were ruined by the dry weather. Very little plowing was done on account of the dry weather, and where attempted the soil was so cloddy that it could not be harrowed. The weather was favorable for the completion of threshing and curing hay, but pastures were generally brown, and in many localities, bare.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of 104 stations was 71.9°, or 0.2° higher than the normal. The western half of the state was generally above normal, and the eastern half, with the exception of two limited areas, was below normal. The contrast in temperature was marked; a small area in the northwestern district showed an

excess of more than four degrees, while there was a deficiency of more than three degrees in the southeastern district. This situation resulted in producing lower mean temperatures at several stations in the southeastern district, generally the warmest portion of the State, than several in the northwestern district, which normally is considerably cooler. The highest monthly mean was 75.3° at Lenox and Thurman and the lowest was 67.0° at Postville. The absolute range for the state was 65°, from 102°, at Keokuk, No. 2 on the 22d to 37° at Decorah on the 15th. The average number of days with the maximum temperature 90°, or higher, was 6. The greatest average was in the southwestern district with 12 days and least in the north-central district with 2. The greatest number at a single station was 15 at Lenox while at Forest City and Mason City the temperature did not reach 90°.

Precipitation. The average precipitation for the State, derived from the averages of nine divisions of nearly equal area, and based on the records of 119 stations, was 2.44 inches, or 1.00 inch less than the normal. There was a deficiency in each division, though several areas showed excesses, and in the area extending from Marshall to Cedar Counties the excess was pronounced, due to the torrential rain on the 2d. The average number of rainy days was 6, ranging from 8 in the northwestern to 4 in the north-central and northeastern districts. The greatest number of rainy days at a single station was 12, and the least was 1. Rains occurred at frequent intervals and the greater portion fell during the first two weeks. Locally heavy rains occurred on the 25th and 31st over much of the State, but during all the rain periods there were portions that received only light sprinkles. The greatest rainfall reported was 9.27 inches at Toledo, and the least was 0.78 inch at Guthrie Center. The greatest amount occurring within a 24-hour period was 8.35 inches at Toledo on the 2d.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.03	30.34	19	29.68	13	80	50	58	26	26	3,360	4.5	19	nw.	10	78	+ 7
Davenport	30.03	30.29	19	29.67	13	79	52	59	33	3	4,428	6.0	28	w.	27	79	+ 9
Des Moines	30.01	30.30	19	29.66	13	82	52	57	30	18	3,851	5.2	18	sw.	2	70	0
Dubuque	30.03	30.32	19	29.75	13	81	51	56	36	24	3,170	4.3	21	n.	13	64	0
Keokuk	30.01	30.27	19	29.71	13	78	54	60	32	4	3,602	4.8	24	s.	2	69	— 4
Sioux City	29.99	30.28	27	29.68	2	78	51	52	33	14	6,504	8.7	38	n.	11	85	+15
Omaha, Neb.	29.99	30.22	27	29.67	2	76	51	55	32	30	4,237	5.7	26	nw.	13	73	+ 3
Means and extremes	30.02	30.34	19	29.66	13	79	52	57	26	26		5.6	38	n.	11	74	+ 4
Normals and records	29.97	30.45	24th 1919	29.40	10th 1874	82	61	¶19	5th 1918				57	sw.	6th 1916	70	

‡Local mean time. †And other dates. §Sioux City. ¶Omaha. ‖Des Moines.
‡‡See footnote under similar table at end of January.

Miscellaneous Phenomena. Aurora: 15th. Fog: 8th, 9th, 11th, 18th, 25th, 26th, 27th, 28th, 29th, 30th. Frost: (light), 15th. Hail: 1st, 2d, 10th, 12th, 13th, 22d. Halos (lunar and solar): 4th. Haze: 11th, 18th, 20th, 24th, 25th, 26th, 27th, 28th, 30th. Thunderstorms: 1st, 2d, 4th, 5th, 8th, 9th, 10th, 11th, 12th, 13th, 16th, 17th, 20th, 21st, 22d, 23d 25th, 29th, 30th, 31st.

Rivers. Low stages prevailed on the principal rivers of the State and the average stage was considerably below normal. There was a slow steady fall on the Missouri River throughout the month, the total fall amounting to more than two feet: there was a general falling tendency on the Mississippi River with nearly stationary stages, except there was a material rise below the mouth of the Iowa River during the latter part of the 1st week, due to abnormally heavy rains in the Iowa river drainage basin on the 2d. There were a few moderate rises on the other interior trams, but no serious damage occurred except on the Iowa river and its tributaries.

SEPTEMBER

There were no unusual features in connection with the weather during September, 1929. The temperature averaged somewhat below the normal but the deficiency was just one-half of what it was a year ago. Temperatures were rather uniform, with very few fluctuations. The month opened with a rather warm period of three days duration, and the maxima for the month occurred within this period. Following this brief period there was a decided change to cooler, and until the end of the third week temperatures were almost continuously below normal. This period was followed by a week of warm weather and the last two days were considerably below normal. Light frost occurred in favorable localities in northern districts on the 5th, and a larger number on the 10th and 11th, but there was little or no damage. Frost was general over most northern and central sections on the 14th and 16th, which caused slight damage in scattered areas. A general frost occurred on the 18th that affected the entire State except small areas in the extreme southern portion. Over practically all northern and most central districts, this frost was killing, and over the rest of the State the damage was in varying degrees. In that portion of the State where the freezing was most severe, corn was well matured generally and only some late fields were badly injured. There will be some chaffy corn in localities, but the amount will not be large. In portions of the State the growth of corn was not stopped, and at the end of the month there were fields along the Mississippi river and some bottom lands in the southern portion of the State that were still subject to damage from freezing. Truck crops were generally killed in all northern districts, and some damage resulted in the rest of the State, but as there was no subsequent freezing after the 18th, some crops made a recovery and a number of commercial canneries were still operating at the end of the month, and fresh vegetables continued plentiful.

Rainfall was generally ample and very evenly distributed except in a few small areas, the principal dry area being in the vicinity of Dubuque. In this district pastures were generally bare and the soil was too dry to plow. In the rest of the State conditions were generally favorable; plowing has progressed satisfactorily, and some wheat had been seeded and was

up in places showing a good stand. A large number of places reported heavy daily amounts of rainfall, but in nearly all cases the rate of fall was slow and few heavy downpours occurred. Storms of a damaging character were almost entirely lacking, though thunderstorms occurred on a large number of days. The greatest damage occurred on the 8th in Wapello and Marion counties.

Temperature. The mean temperature for the State derived from the means of nine districts of nearly equal area, and based on the records of 105 stations, was 62.4°, or 1.9° below normal. The greatest deficiency occurred in the extreme northwest portion, but in general the greatest deficiency was in the western portion and it diminished gradually to the east; the deficiency at a number of stations near the Mississippi River was less than one half degree and one station reported a slight excess. The highest monthly mean was 66.3°, at Keokuk, No. 2, and the lowest 57.6°, at Rock Rapids. The absolute range for the state was 73°, from 98° at Decorah on the 2d, to 25° at Humboldt, Sanborn and Webster City on the 18th. Temperatures of 90°, or higher, occurred at all but four stations and the average number for the State was two; the greatest number was four at Wever. All stations in the three northern disricts had one or more days of freezing weather except Dubuque. The average number for the State was less than one, the greatest number at any station was three; at about one-third of the stations the temperature did not reach freezing.

Precipitation. The average precipitation for the State, derived from the averages of nine divisions of nearly equal area, and based on the records of 118 stations, was 3.74 inches, or 0.07 inch more than the normal. The precipitation was uniformly distributed over most of the State, there being but one rather small area in the northeastern portion that had a pronounced

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.05	30.44	18	29.68	13	83	52	66	30	6	4,201	5.8	22	sw.	2	54	+ 3
Davenport	30.04	30.38	18	29.68	4	80	55	61	32	23	5,140	7.1	39	s.	14	68	+ 5
Des Moines	30.02	30.42	18	29.67	15	82	54	62	31	14†	4,322	6.0	25	sw.	15	59	— 3
Dubuque	30.05	30.41	18	29.68	13	78	50	59	31	24	3,792	5.3	39	s.	15	56	— 3
Keokuk	30.05	30.40	18	29.72	4	81	55	63	33	14	3,901	5.4	27	sw.	4	63	— 1
Sioux City	30.02	30.43	18	29.58	15	84	60	64	28	5	7,765	10.8	39	s.	23	50	—13
Omaha, Neb.	30.02	30.41	18	29.66	15	81	53	59	31	10†	4,969	6.9	26	nw.	6	62	— 3
Means and extremes	30.04					81	54	62				6.8				60	— 2
		30.44	18	29.58	15				28	5			39	s.	23		
Normals and records	30.02		25th		29th	83		64		28th					7th	62	
		*30.67	1926	¶29.30	1927				§18	1921			58	w.	1872		

*Sioux City. ¶Des Moines. §Omaha. ‖Davenport. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

deficiency and only a limited area that had a marked excess, embracing a portion of the central and north-central districts. By dividing the State in two divisions, the northwestern division contained nearly all the area with an excess and the southeastern division contained nearly all the area that was deficient. The rainfall occurred at frequent intervals and the principal periods were general over nearly all portions of the State though there were great variations in the amounts. The greatest amount was 7.36 inches at Perry and the least was 1.55 inches at Dubuque. The greatest amount occurring in a 24-hour period was 3.72 inches at Albia on the 9th.

Miscellaneous Phenomena. Fog: 6th, 14th, 16th, 25th, 26th, 27th. Frost: 5th, 10th, 11th, 14th, 16th, 18th, 20th. Halos (lunar and solar): 7th, 11th. Hail: 8th. Thunderstorms: 3d, 4th, 5th, 7th, 8th, 9th, 11th, 12th, 15th, 16th, 18th, 19th, 20th, 25th, 26th, 27th, 28th, 29th, 30th.

Rivers. Low stages prevailed on all rivers. There was considerable fluctuation with falling stages predominating, but the daily changes were slight except a rise of 1.4 feet occurred at Dubuque on the 10th. At all other stations on the principal rivers the extreme stages for the month were less than one foot. On the interior streams the daily changes were slight. The greatest rise reported was 1.2 feet at Van Meter on the 9th, from a stage of 1.8 feet on the 8th to 3.0 feet on the 10th, which were the extreme stages for the month. The extreme stages on most interior streams were less than one-half foot.

OCTOBER

The mean temperature for the State averaged exactly normal but there was an excess over most western districts and a deficiency over most eastern districts, the areas being nearly equal. The chief feature of the temperature in general was the large number of fluctuations above normal, there being a change on an average of every three days. The longest warm period, which was general over the entire State, extended from the 14th to the 20th, and longest cold period extended from the 21st to the 24th. This was the coldest period of the month and the only period in which there was general freezing weather. The general temperature conditions were reflected in the departures as the most pronounced daily excesses were in the western portion of the State, and the most pronounced deficiencies in the eastern portion. Frost occurred frequently, beginning on the 4th, but the areas affected amounted to less than one-half of the State, until the general freeze on the 23d. A large area in the northern portion of the State had killing frost in September but much vegetation that was slightly injured revived and in the extreme southeast portion of the State some crops were uninjured at the end of the month, making a growing season of unusual length. The temperature extremes were less than usual, the maximum for the month being considerably less than the average and the minimum considerably higher than the average.

Precipitation averaged more than 25% more than the normal but the distribution was uneven. A large number of stations in the southern portion had more than double the normal, while several in the north-central and northeastern portions had less than one-half of the normal.

There were two principal precipitation periods in which most of the monthly total occurred that embraced the entire State; the first occurred during the middle of the second week, and the other during the last four days of the month. There were several other periods that were general in sections, the principle one affecting the largest area, occurred on the 19th. An unusual feature in connection with the weather was the large number of cloudy days that were entirely cloudy and the large number of clear days that were cloudless.

Foggy days were unusually numerous and this fact was emphasized by the effect that it had on air transportation. The number of cloudy days was more than the average, and at times the ceiling was very low, making flying difficult, and with the foggy condition during the last four days caused almost a complete suspension.

From an agricultural standpoint the month was not entirely favorable. The frequent rains interfered with corn husking and would not permit drying so that it could be safely cribbed. Sugar beets were harvested, with no damage from freezing, and commercial canneries were able to complete operations with very little loss of material. Outside work was interrupted only by rainy weather, and building operations and road construction was pushed as much as possible. The frequent rains kept dirt roads in poor condition most of the time, and detours where paving was in progress were generally in bad condition.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of 104 stations, was 51.8°, or just equal to the normal. There were four districts with an excess, four that were deficient and one district that was exactly normal. In general the excess occurred in the western portion of the State and the deficiency in the eastern portion. The highest monthly

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.07	30.49	8	29.60	31	87	56	67	23	25	4,330	5.8	23	nw.	12	59	— 7
Davenport	30.05	30.38	9	29.65	26	83	56	63	24	7	6,313	8.5	33	ne.	28	57	— 4
Des Moines	30.04	30.36	8	29.55	31	85	56	62	22	25	6,394	8.6	30	e.	28	57	— 6
Dubuque	30.05	30.43	9	29.61	26	85	56	61	28	27†	4,121	5.5	24	n.	12	66	— 1
Keokuk	30.06	30.36	8	29.72	26	83	55	64	22	7	4,666	6.3	22	ne.	28	58	— 3
Sioux City	30.06	30.41	7	29.65	26	80	57	60	23	7	7,228	9.7	39	e.	28	65	— 10
Omaha, Neb.	30.05	30.37	7	29.71	28	79	55	59	21	25	4,901	6.6	30	nw.	23	58	— 1
Means and extremes	30.07	30.43	9	29.55	31	83	56	62	21	25	7.3		39	e.	28	54	— 7
Normals and records	30.03	*30.69	31st 1913	§28.96	20th 1876	81		62	¶16	6th 1928			49	sw.	16th 1880	60	

*Davenport; also Sioux City on the 29th, 1928. §Omaha. ¶Des Moines. ‖Davenport ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

mean was 55.8° at Keokuk, No. 2 and the lowest was 48.2° at Decorah and Postville. The absolute range for the State was 61°, ranging from 84°, at Spencer on the 15th, to 23° at Boone, Harlan and Webster City on the 25th. Temperatures of 32°, or lower, occurred at all stations. The average number of days with freezing temperatures was 5, ranging from seven in the northwestern and north-central districts, to two in the south-central and southeastern districts. The greatest number at any station was 11 at Decorah and Mason City; the least number was 1 at 7 stations, 5 of which were Regular Weather Bureau stations.

Precipitation. The average precipitation for the State, derived from the averages of nine districts of nearly equal area, and based on the records of 119 stations, was 3.10 inches, or 0.67 inch more than the normal. All stations in the three southern districts and the east-central district showed an excess. The principal deficient area was in the northeastern, central and north-central districts, but the northeastern was the only district that was deficient at all stations. The greatest monthly amount was 6.55 inches at Bedford, and the least was 1.10 inches at Webster City. The greatest amount occurring in 24 consecutive hours was 2.18 inches at Riverton on the 19th.

Snowfall. The average snowfall for the State was 0.7 inch. The greatest amount was 6.5 inches at Northwood. At more than one-half of the stations there was no snow, or only a trace. The snow melted soon after falling and much melted as it fell. At only one station was the ground snow-covered more than 24 hours.

Miscellaneous Phenomena. Fog: 1st, 2d, 3d, 4th, 5th, 8th, 11th, 12th, 13th, 14th, 16th, 28th, 29th, 30th, 31st. Frost: 4th, 5th, 7th, 8th, 11th, 12th, 13th, 14th, 17th, 21st, 23d, 24th, 25th. Hail: 29th, 31st. Halos (lunar and solar): 21st, 22d. Sleet: 23d, 24th, 28th, 29th. Thunderstorms: 9th, 10th, 11th, 12th, 18th, 19th, 20th, 28th, 29th, 30th, 31st.

Rivers. Low stages prevailed on all rivers. There were numerous slight fluctuations. On the Mississippi River the extreme stages were less than one-half of a foot and on the Missouri the extremes were less than one foot.

NOVEMBER

The mean temperature for the State was 32.3 degrees, or 4.3 degrees below normal, and 6.4 degrees less than for the same month a year ago. The temperature deficiency was greatest in the central district, where it averaged 4.7 degrees, and least in the east-central district where it averaged 3.8 degrees. The outstanding temperature feature was the cold weather throughout the State on the last two days of the month. In a large part of the east and central sections it was the coldest for the past 31 years. The coldest for the State was 12 below zero on the 30th at Webster City. No large temperature fluctuation occurred in the first 18 days. A cold period prevailed from the 19th to the 24th; then a warm period from the 25th to the 27th inclusive, followed by the last three days of the month with an extreme cold period.

Precipitation averaged 20 per cent less than normal but the distribution was uneven. Most of the stations in the south-central and southwest

districts had precipitation in excess of the normal, but the other seven districts were below normal. There were three principal precipitation periods in which most of the monthly total occurred, the first being between the 10th and 13th, the second between the 18th and 20th, and the third during the last four days of the month.

From the agricultural standpoint the month was generally favorable and much fall plowing was done. Unsettled weather interfered somewhat with corn husking in the southern districts, but in the northern half of the State this work was more than 90 per cent completed by the end of the month. Conditions were decidedly favorable for corn picking machines, there being an unusually large number used this year. Outside work was not greatly interrupted by the cold weather, and building operations and road construction were pushed as much as possible. The road construction companies, taking advantage of the opportunities in their favor, did not pour a large amount of cement at a time, and followed close behind with covering for protection from freezing. The dirt roads were generally in good condition, and detours where paving was in progress were generally in bad condition.

The unusually cold weather toward the end of the month, and ice conditions causing unusually low stages on the Mississippi River, resulted in the temporary shutdown of manufacturing concerns because there was insufficient water to operate the power plants.

In connection with a passing storm on the 27th, unusually strong winds occurred, which caused considerable damage. Plate glass windows were broken by the high wind. In the country small buildings of all description were racked and blown down.

Temperature. The mean temperature for the State, derived from the means of nine districts of nearly equal area, and based on the records of 103 stations, was 32.3°, or 4.3° below normal. There was a deficiency in all divisions of the State. The greatest deficiency, 4.7°, was in the central district. The east-central district had a deficiency of 3.8°, which was the least for the State. The highest monthly mean was 37.4° at Keokuk, No. 2, and the lowest was 28.2° at Sanborn. The absolute range for the State was 78°, from 66° at Ottumwa on the 11th, to —12° at Webster City on the 30th. Temperatures of 32° or lower, occurred at all stations. The average number of days with minimum temperatures 32° or lower was 25, ranging from 28° in the northwest, north-central and west-central districts, to 20° in the southeast district. The highest temperature observed in the State was 66° at Ottumwa, which was the lowest November State maximum since 1881, when 65° was reached. The average number of days with temperature zero or lower was 2, ranging from 4 days at 12 stations, to none at Sioux City, Omaha and Keokuk, these being regular Weather Bureau stations with city exposures. The average number of days with the maximum temperature 32° or lower, was 6, ranging from 9 at stations in the northwest and north-central districts, to 3 recorded in the southeast district at Keokuk No. 2 and Wever.

Precipitation. The average precipitation for the State, derived from the averages of 9 districts of nearly equal area, from the records of 112 stations, was 1.24 inches, or 0.31 inch below normal. There was an excess in

the south-central and east-central districts, the remaining seven being below normal. The precipitation which fell in the extreme southwest section of the State was mostly snow. The greatest amount at a single station was 2.58 inches at Williamsburg, and the least was 0.08 at Lake Park. The greatest amount occurring in 24 consecutive hours was 1.27 inches at Williamsburg on the 13th. The average number of days with precipitation 0.01 inch or more for the State, was 6.

Snowfall. The average snowfall for the State was 2.7 inches, or 0.4 inch above normal. The average snowfall for most of the State in general was much below normal and in many localities only a trace of snow recorded, but the heavy snowfall in the extreme southwestern section made the State average above normal. The greatest snowfall was 11.0 inches at Logan and Thurman on the 28th, and the least was a trace reported at 8 stations.

Rivers. Moderately low stages prevailed on all the interior streams with falling stages the latter half of the month. On the Mississippi River the highest stage was reached during the middle of the month, after which it fell continuously, with an extreme fluctuation of 1.9 feet. On the Missouri River the stages averaged above normal. At Sioux City the extreme stages were 4.9 and 5.4 feet, and the average stage exactly normal at 5.2 feet. At Omaha the extreme stages were 4.4 and 7.6 feet. The highest stages prevailed during the first half of the month and the lower stages from the 24th to the 27th, the average being 0.8 foot above normal.

Miscellaneous Phenomena. Aurora: 2d, 3d. Fog: 9th, 10th, 11th, 14th, 15th, 16th, 17th. Hail: 3d, 29th, 30th. Halos (lunar and solar): 8th, 11th, 17th, 18th, 21st, 22d, 25th, 29th. Sleet: 3d, 16th, 18th, 19th, 27th. Thunderstorms: 12th, 13th. Wind (unusually strong): 22d, 27th.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	1P Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.13	30.78	21	29.48	27	89	65	76	37	17	4,303	6.0	22	nw.	27	51	+ 4
Davenport	30.12	30.79	21	29.46	27	86	62	68	42	2	6,814	9.5	33	nw.	27	49	— 2
Des Moines	30.14	30.78	21	29.58	27	86	59	70	36	2	6,767	9.4	40	nw.	27	60	+ 8
Dubuque	30.11	30.71	21	29.49	27	81	64	70	40	2	4,419	6.1	22	nw.	27	52	+ 6
Keokuk	30.16	30.75	21	29.59	27	78	55	66	25	29	5,183	7.2	37	w.	27	50	— 1
Sioux City	30.17	30.84	21	29.65	26	84	64	68	42	26	7,710	10.7	44	nw.	27	53	+ 1
Omaha, Neb.	30.17	30.80	21	29.71	26	79	60	65	32	2	5,727	8.0	30	nw.	18†	59	+ 4
Means and extremes	30.14	30.84	21	29.46	27	83	61	69	25	29		8.1	44	nw.	27	53	+ 3
Normals and records	30.07	*30.96	2d 1896	§29.03	28th 1918	81		72	¶16	6th 1916			§51	sw.	10th 1919	50	

*Sioux City. §Davenport. ¶Omaha. ‖Keokuk. ‡Local mean time. †And other dates. ‡‡See footnote under similar table at end of January.

DECEMBER

December temperature averaged slightly above normal, with an abnormally mild period from the 24th to the end of the month, but cold periods, with below zero temperatures, prevailing during the opening days of the month and from the 18th to 24th. The greatest departures, amounting to one or two degrees above normal, occurred from the Raccoon Valley south and east to the boundaries of the State, while scattered stations elsewhere had slight deficiencies. The preceding December was much milder.

The maximum temperature for the month occurred at all but three stations on the 30th. During this unusually mild period, several records were broken in maximum temperatures for so late a date in the season. At Davenport, the highest temperature recorded was 61° on the 30th, this being the highest temperature ever observed on any December 30th since the station was established, the previous record being 60° in 1875. Likewise, the maximum of 54° on the 26th exceeded the record for that date, made in 1928, by 5°. At Des Moines, the highest temperature recorded was 61° on the 30th, this being the highest temperature ever observed on that date since the station was established; the previous record was 53° in 1896. Also, the maximum temperature of 55° on the 29th exceeded the record for that date, made in 1908. At Davenport, the lowest reading was —1° on the 3d, equalling the low record for that date made in 1886. Cold waves passed over the State on the 2d and 18th.

Precipitation averaged 66% less than normal, and was evenly distributed. All of the stations throughout the State were below normal. The two principal precipitation periods were on the 1st and 8th-18th.

Beginning on the 7th and ending on the 17th, the State experienced one of the most persistent cloudy and foggy periods of record. At most places in the State the sun was not visible for 10 days. In the vicinity of Davenport the sky was cloudy for 14 consecutive days, 6th-19th, during which time there were 11 consecutive days with not a glint of sunshine, setting a new record for absolute cloudiness. Throughout the remainder of the State there were 10 consecutive days with no sunshine. At Des Moines the absence of sunshine for 10 consecutive days exceeded by 4 days the previous record of consecutive days without sunshine. During this unprecedented period of gloom all flying ceased. At the airports throughout the State there were no incoming planes, and those which landed on the 8th were unable to leave until the 18th because of the uncertainty of finding favorable landing conditions at other terminals. Air mail was generally dispatched by train.

From the agricultural standpoint the month was generally unfavorable. During the milder periods there was some corn husking; and very little corn remained in the field by the end of the month. The snow cover was unusually light during the entire month. Some corn shelling and marketing occurred during the favorable and mild periods.

Road construction and building were practically suspended throughout the State because of unfavorable conditions.

Temperature. The mean temperature for the State, derived from the means of 9 districts of nearly equal area, and based on the records of 102 stations, was 24.8°, or 0.7° above normal. There was an excess in all the divisions of the State except the northeast district, and this district averaged exactly normal. The greatest excess, 1.2°, was in the south-central district. The highest monthly mean was 30.0° at Keokuk, and the lowest was 19.2° at Rock Rapids. The absolute range for the State was 83°, from 67° at Guthrie Center on the 30th, to —16° at Britt and Forest City on the 19th. Temperatures of zero or lower occurred at all stations, ranging from 10 days at Sioux Center, to 1 at each of the three stations, Dubuque, Davenport and Fairport. The average number of days with minimum temperature 32° or lower, was 28, ranging from 31 days in the northwest, north-central and northeast districts, to 26 days in the southeast district. The average number of days with temperature zero or lower, was 6. The average number of days with the maximum temperatures 32° or lower, was 13, ranging from 21 days at three of the stations in the northwest district, to 8 days at four stations in the southeast district.

Precipitation. The average precipitation for the State, derived from the averages of 9 districts of nearly equal area, and based on the records of 113 stations, was 0.39 inch, or —0.75 inch below normal. The greatest district deficiency was in the east-central district, —0.98 inch, and the least was in the northwest district, —0.55 inch. There was a deficiency at every station, Clinton having the greatest, 1.34 inches, while Lake Park, with 0.25 inch, had the least. More than 75% of the precipitation was in the form of snow. The greatest amount at a single station was 1.21 inches at Burlington, and the least was 0.03 inch at Glenwood. The greatest amount occurring in 24 consecutive hours was 0.91 inch at Burlington on the 1st. The average number of days with precipitation 0.01 inch or more for the State was 5.

Snowfall. The average snowfall for the State was 3.8 inches, or 2.2 inches below normal. The greatest total snowfall for the month was 8.5 inches at Burlington, and the least, 0.3 inch at Glenwood. The greatest snowfall in 24 hours was 8.0 inches at Burlington on the 1st.

Rivers. Moderately low stages prevailed on all the interior streams with little fluctuation in their stages. The interior streams were frozen over the entire month. On the Missouri River the stages averaged below normal. At Sioux City, the extreme stages were 3.4 and 5.4 feet, and the average stage was 4.2 feet or 0.5 feet below normal. At Omaha the extreme stages were 3.3 and 5.9 feet, and the average stage was 4.2 feet or 1.5 feet below normal. The Missouri River froze at Omaha on the 19th, but reopened on the 26th. The low stages prevailed at both stations from the 6th to the 20th, and much higher stages prevailed the remaining period of the month.

On the Mississippi River a peculiar situation existed in the river stages. At Dubuque, the average stage for the river was higher than during any of the four preceding months. The lowest stage, 2.2 feet, was registered on the list. The water rose steadily to 5.1 feet, the highest of the month, on the 10th. The stage was maintained until the 19th, after which a slow fall set in and continued to the end of the month. The river was frozen throughout the month. Ice measurements showed an average thickness of

6 inches on the 3d; 8 inches on the 10th; 7 inches on the 16th, and 10 inches on the 23d and 30th. At Davenport the extreme stages were 0.4 and 5.0 feet, and the average stage was 2.9 feet or 0.1 foot above normal. The lowest stage, 0.4 foot, was registered on the 2d. The water rose steadily to 5.0 feet, the highest of the month, on the 21st, 22d and 23d, after which it continued to fall until the stage of 3.2 feet was reached on the 31st. At Keokuk the river was the lowest this month that it has been for several years. The average stage was 0.6 foot below the zero of the gage, and the lowest reading was 3.1 feet below the zero of the gage, which equals the lowest stage on record.

Miscellaneous Phenomena. Aurora: 3d, 4th, 5th. Fog: 5th, 6th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 22d, 23d, 31st. Haze: 13th, 14th, 15th, 16th, 31st. Halos (lunar and solar): 2d, 5th, 6th, 18th, 19th, 20th, 26th, 31st. Sleet: 8th, 10th, 11th, 12th, 14th, 15th, 16th, 17th. Glaze: 9th, 10th, 11th, 12th, 14th, 15th, 16th, 17th, 18th.

PRESSURE, RELATIVE HUMIDITY, WIND AND SUNSHINE

Stations	Barometric Pressure, Inches (Sea Level)					Relative Humidity, %					‡‡Wind					Sunshine	
						Mean							Maximum				
	Mean	Highest	Date	Lowest	Date	7 A. M.	12 Noon‡	7 P. M.	Lowest	Date	Total movement	Average hourly velocity	Miles	From	Date	% possible	Departure from normal
Charles City	30.09	30.65	2	29.55	26	94	79	88	44	30	4,407	5.9	18	n.	18	46	+ 3
Davenport	30.07	30.57	17	29.59	30	89	75	80	42	30	6,916	9.3	31	n.	18	57	+ 5
Des Moines	30.09	30.63	21	29.58	31	88	72	79	31	30	6,594	8.9	30	n.	18	50	0
Dubuque	30.00	30.59	21	29.53	30	90	79	82	42	30	4,310	5.8	23	n.	18	38	— 4
Keokuk	30.10	30.64	21	29.62	31	84	71	78	41	3	5,263	7.1	25	nw.	28	45	— 2
Sioux City	30.13	30.77	18	29.55	31	84	74	76	30	30	7,957	10.7	34	nw.	1	52	+ 3
Omaha, Neb.	30.12	30.69	21	29.56	31	83	70	72	31	30	5,565	7.5	30	nw.	17,18	55	+ 4
Means and extremes	30.09	30.77	18	29.53	30	87	74	79	30	30	7.9		34	nw.	1	46	0
Normals and records	30.12	*31.09	29th 1917	§29.00	13th 1920	84	77	¶18	12th 1922		*47	nw.	24th 1907	46			

*Sioux City. §Dubuque. ¶Keokuk. ‡Local mean time. †And other dates.
‡‡See footnote under similar table at end of January.

MONTHLY STATE DATA FOR 1929

MONTH	Barometric Pressure Inches (Sea Level)				Temperature Degrees, F.				Rel. Humidity, Per Cent			Precipitation, Inches				No. of Days				Sunshine		Wind	
	Mean	Highest	Date	Lowest	Mean	Departure from normal	Highest	Lowest	7 a. m.*	12 noon†	7 p. m.*	Departure from normal	Lowest	Average	Departure from Normal	Greatest	Least	Snowfall	With .01 inch or more precipitation	Clear	Partly cloudy	Cloudy	Per cent of the possible amount	Departure from normal	Average hourly velocity	Prevailing direction
January	30.15	30.65	7	29.27	10.2	8.3	47	—29	83	73	79	+	1.34	2.06	+0.99	4.10	0.40	17.5	9	11	6	14	44	— 7	8.1	nw.
February	30.16	30.72	1	29.33	14.0	8.6	52	—35	88	71	79	+	6.27	1.31	+0.10	3.00	0.34	12.5	6	10	7	11	50	— 5	6.8	nw.
March	29.91	30.60	9	29.17	39.1	4.5	83	— 5	80	61	63	+	2.9	1.44	—0.33	4.95	0.90	3.5	5	12	8	11	54	— 3	8.7	nw.
April	29.88	30.31	24	29.17	51.2	2.3	88	9	77	56	58	+	2.14	4.62	+1.66	7.97	1.81	1.1	11	12	8	10	56	— 1	8.9	se.
May	30.04	30.50	9	29.49	57.7	2.4	91	24	75	52	53	—	4.19	2.47	—2.11	5.79	0.82	T.	8	11	12	8	62	0	7.4	s.
June	29.93	30.33	3	29.44	67.6	1.7	90	38	75	53	54	—	6.23	3.08	—1.62	8.47	0.82	0	14	14	9	7	66	+ 1	6.9	sw.
July	29.99	30.30	20	29.61	74.1	0.4	98	43	78	54	58	—	0.24	4.31	+0.48	10.30	1.47	0	9	16	10	5	67	+ 4	6.6	sw.
August	30.02	30.34	19	29.66	71.9	0.2	102	37	79	52	57	—	4.96	2.44	—1.00	9.97	0.78	0	6	18	7	6	74	+ 9	6.8	se.
September	30.04	30.44	18	29.58	62.4	1.9	98	35	81	54	62	—	2.98	3.74	+0.07	7.96	1.55	T.	6	14	7	9	60	+ 6	6.8	se.
October	30.07	30.43	9	29.55	51.8	0.0	84	23	83	56	63		0.21	3.10	+0.67	6.55	1.10	0.7	5	15	5	11	54	— 3	7.3	nw.
November	30.14	30.84	21	29.46	32.3	4.3	66	—12	83	61	69	+	0.55	1.24	—0.31	2.58	0.08	2.7	5	13	8	9	53	+ 3	8.1	nw.
December	30.09	30.77	18	29.53	24.8	0.7	67	—16	87	74	79	+	2.80	0.39	—0.75	1.23	0.08	3.8	5	12	6	13	46	0	7.9	nw.
Means and Extremes	30.04	30.84	Nov. 21	29.17	46.4	1.6	102	—35	81	66	69	+	6.27	30.30	—1.06	10.30	0.08	41.8	94	158	95	112	57	— 2	7.4	nw.
Normals and Records	30.02	31.09	Jan. 25 1905	28.69	48.0		113	—47	81	66	71		5	32.15		19.80	0.00	30.7	85	166	101	98	59			

‡Local mean time. *Normal central time. †And other dates. 7 A. M. and 7 P. M. observations only.

DATES OF KILLING FROSTS, 1929

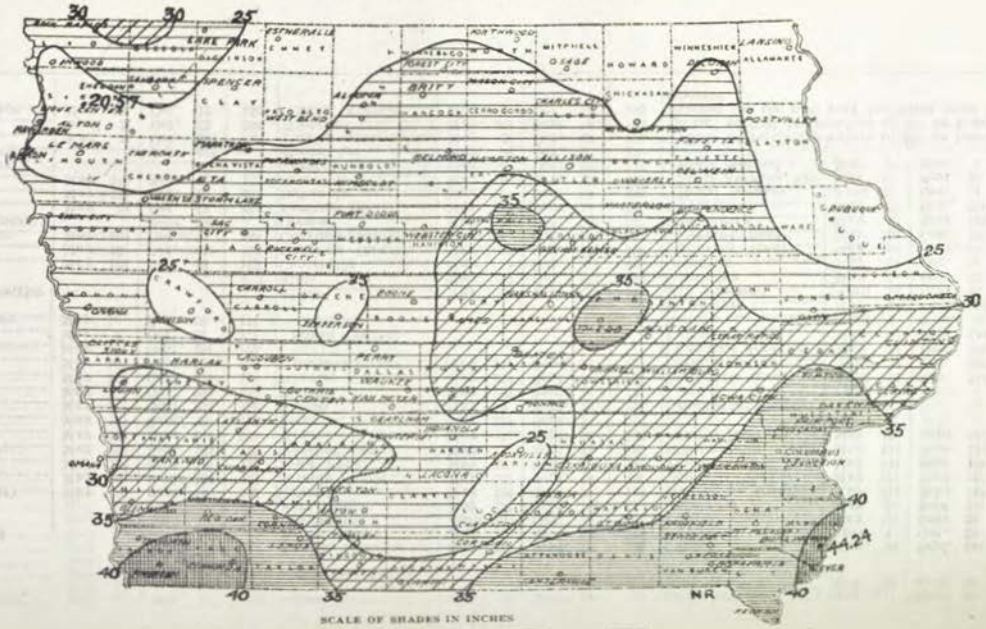
Charles City, Davenport, Des Moines, Dubuque, Keokuk, Sioux City, Omaha and Marshalltown, excluded from averages because of city influences.

STATIONS	Last in Spring	First in Autumn	Days in growing season
Northwest District			
Alta	May 16	Sept. 18	125
Alton	May 16†	Sept. 18	125
Cherokee	May 16†	Sept. 18†	125
Estherville	May 19†	Sept. 18	122
Inwood (near)	May 16	Sept. 18	125
Lake Park (near)	May 16†	Sept. 18†	125
Le Mars	May 16†	Sept. 18	125
Pocahontas	May 19†	Sept. 18†	122
Rock Rapids	May 16†	Sept. 18	125
Sanborn	May 16†	Sept. 18	125
Sheldon	May 16†	Sept. 18	125
Sioux Center	May 16†	Sept. 18†	125
Spencer	May 16†	Sept. 18†	125
Storm Lake	May 16†	Sept. 18	125
Washta	May 21†	Sept. 18	120
West Bend	May 19†	Sept. 18†	122
Rural Average	May 17	Sept. 18	124
North Central District			
Algona	May 16†	Sept. 18	125
Allison	May 19	Sept. 18†	122
Belmond	May 19	Sept. 18	122
Britt	May 19†	Sept. 18	122
Charles City	May 9	Sept. 18	132
Forest City	May 19†	Sept. 18	122
Hampton			
Humboldt	May 19†	Sept. 18	122
Mason City	May 19	Sept. 18	122
Northwood	May 19†	Sept. 18	122
Osage	May 19†	Sept. 18†	122
Rural Average	May 19	Sept. 18	122
Central District			
Ames	May 7†	Sept. 18	134
Northeast District			
Decorah	May 19†	Sept. 18	122
Debuque	April 1†	Oct. 23	205
Fayette	May 19	Sept. 18	122
Independence	May 19†	Sept. 18†	122
New Hampton	May 19†	Sept. 18	122
Oelwein	May 19†	Sept. 18†	122
Postville (near)	May 21†	Sept. 18	120
Waterloo	May 19†	Sept. 18	122
Waverly	May 19†	Sept. 18	122
Rural Average	May 19	Sept. 18	122
East Central District			
Belle Plaine	May 19†	Sept. 18	122
Cedar Rapids	May 21†	Sept. 18	120

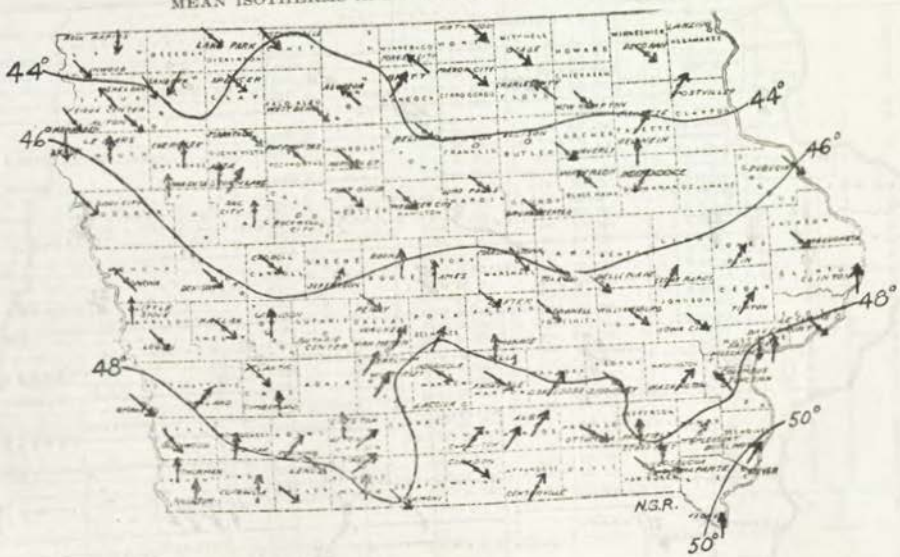
STATIONS	Last in Spring	First in Autumn	Days in growing season
West Central District			
Audubon (near)	May 16†	Sept. 18	125
Carroll	May 16†	Sept. 18†	125
Denison	May 16†	Sept. 18†	125
Guthrie Center	May 16†	Sept. 18†	125
Harlan	May 16†	Oct. 21†	158
Jefferson	May 16†	Sept. 18†	125
Little Sioux	May 16†	Oct. 21†	158
Logan	May 16†	Oct. 21†	158
Onawa	May 16†	Oct. 21†	158
Rockwell City	May 16†	Sept. 18†	125
Sac City	May 16†	Sept. 18†	125
Sioux City	May 5	Oct. 23	171
Rural Average	May 16	Sept. 30	137
Southwest District			
Atlantic	May 16†	Sept. 18	125
Clarinda	May 16†	Oct. 21†	158
Corning	May 16†	Oct. 21	158
Cumberland (near)		Sept. 18†	
Glenwood	May 2†	Oct. 13	164
Lenox	May 16†	Oct. 25	162
Oakland	May 16†	Sept. 18†	125
Red Oak (near)			
Riverton (near)		Oct. 21†	
Thurman	May 2†	Oct. 25†	176
Omaha, Neb.	April 2†	Oct. 23	204
Rural Average	May 12	Oct. 12	153
Baxter	May 19†	Sept. 18	122
Boone (near)	May 21	Sept. 18	120
Des Moines	April 13	Oct. 25	195
Fort Dodge	May 19†	Sept. 18†	122
Grinnell	May 19†	Sept. 18	122
Grundy Center	May 19†	Sept. 18	122
Iowa Falls	May 19	Sept. 18	122
Marshalltown	May 19	Sept. 18	122
Monroe	May 5	Sept. 18	136
Perry	May 21†	Sept. 18	120
Toledo	May 19	Sept. 18	122
Waukee	May 16†	Sept. 18	125
Webster City	May 21†	Sept. 18	120
Rural Average	May 17†	Sept. 18	124
South Central District			
Afton	May 2†	Oct. 25†	176
Albia	May 5†	Oct. 25†	173
Centerville	May 5†	Oct. 25†	173
Chariton (near)	May 5†	Oct. 22†	170
Corydon (near)	April 15	Oct. 23†	191
Creston	May 3†	Oct. 23†	173
Earlham (near)	May 16†	Sept. 18	125
Indianola	May 5†	Sept. 18	136
Knoxville	May 5†	Oct. 23†	171
Lamoni	May 3†	Oct. 23†	173
Mount Ayr	May 5†	Oct. 25	173
Tingley	May 2†	Oct. 25	176
Winterset	May 16†	Sept. 18	125
Rural Average	May 4	Oct. 16	165
Clinton	May 5†	Sept. 18†	136
Davenport	April 1	Oct. 23	205
Fairport	May 4†	Oct. 23	172
Iowa City	May 5	Sept. 18†	136
Maquoketa (near)	May 21†	Sept. 18†	120
Olin	May 21†	Sept. 18†	120
Tipton (near)	May 19†	Sept. 18†	122
Williamsburg	May 21†	Sept. 18†	120
Rural Average	May 15	Sept. 22	130
Southeast District			
Bonaparte (near)	April 2†	Oct. 23†	204
Burlington	April 1†	Oct. 23†	205
Columbus Junction	May 5†	Oct. 23†	171
Fairfield	May 5†	Sept. 18†	136
Keokuk	April 1	Nov. 9	222
Keosauqua	May 5†	Oct. 23†	171
Mt. Pleasant	April 2†	Oct. 23	204
Oskaloosa	May 5	Oct. 23	171
Ottumwa	May 6†	Oct. 25	172
Sigourney (near)	May 5†	Sept. 18	136
Stockport (near)	May 5†	Oct. 23†	171
Washington	May 5†	Sept. 18†	136
Wever	May 5†	Oct. 23†	171
Rural Average	April 27	Oct. 14	170
State Average, 1929	May 13	Sept. 28	138
State Normal	May 3	Oct. 5	155

†Date of last temperature of 32° or lower in the Spring, or first temperature of 32° or lower in the Autumn (as the case may be) when frost was not reported.

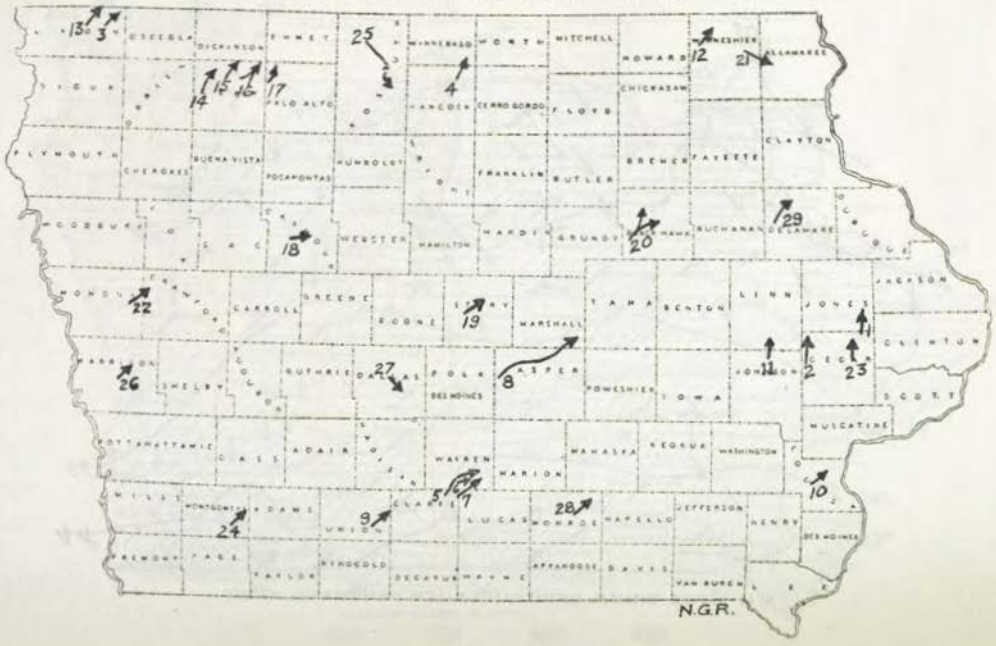
TOTAL PRECIPITATION, YEAR, 1929



MEAN ISOTHERMS AND PREVAILING WINDS, YEAR, 1929



TORNADO PATHS IN IOWA DURING THE YEAR, 1929



TORNADOES IN IOWA DURING THE YEAR, 1929

	Nearest Towns	Date	Time	Direction	Length of Path	Persons Injured	Persons Killed	Estimated Damage
1.	Oxford Junction	March 24	10:00 p. m.	s. to n.	1 mile	0	0	$ 800
2.	Lisbon	March 24	10:00 p. m.	s. to n.	6½ miles	0	0	2,500
3.	Little Rock	April 5	3:00 p. m.	sw. to ne.	3 miles	0	1	20,000
4.	Ellington	April 5	6:30 p. m.	sw. to ne.	2½ miles	4	0	15,000
5.	Madora	April 6	7:30 p. m. to 7:45 p. m.	sw. to ne.	11 miles	8	0	6,000
6.	Madora	April 6	10:30 p. m.	sw. to ne.	1½ miles	0	0	0
7.	Madora to Liberty Center	April 6	7:35 p. m. to 7:45 p. m.	sw. to ne.	6½ miles	0	0	3,200
8.	Valeria to Laurel	April 6	7:10 p. m. to 8:00 p. m.	sw. to ne.	25 miles	0	1	30,000
9.	Thayer	April 6	7:00 p. m.	sw. to ne.	2 miles	0	0	4,000
10.	Bard	April 27	7:00 p. m.	sw. to ne.	2 miles	0	0	2,100
11.	Ely	April 30	8:00 a. m.	sw. to ne.	1 mile	0	0	3,000
12.	Bluffton	April 30	5:00 p. m.	sw. to ne.	1 mile	0	0	4,000
13.	Rock Rapids	May 28	5:00 p. m.	sw. to ne.	4 miles	0	0	6,000
14.	Everly	May 28	5:00 p. m.	sw. to ne.	5 miles	0	0	3,500
15.	Langland	May 31	7:00 p. m.	sw. to ne.	2 miles	0	0	500
16.	Langland (two united)	May 31	7:00 p. m.	sw. to ne.	2 miles	0	0	700
17.	Ruthven	May 31	7:00 p. m.	sw. to ne.	2 miles	0	0	500
18.	Rockwell City	May 31	7:00 p. m.	sw. to ne.	2 miles	0	0	3,000
19.	Nevada	June 11	8:30 a. m.	w. to e.	1½ miles	1	0	2,000
20.	Waterloo	June 11	10:00 a. m.	sw. to ne.	1 mile	0	0	5,000
21.	Decorah to Waukon	June 11	9.45 a. m.	sw. to ne.	4 miles	0	0	5,000
22.	Ute	June 11	10:00 a. m.	nw. to se.	3 miles	8	1	7,000
23.	Clarence	June 31	9:30 p. m.	sw. to ne.	1½ miles	0	0	4,000
24.	Villisca	July 6	2:00 p. m.	s. to n.	1 mile	0	0	500
25.	Bancroft to Titonka	July 16	7:00 p. m.	sw. to ne.	1 mile	0	0	2,000
26.	Logan	August 2	12:30 p. m. to 1:00 p. m.	nw. to se.	12 miles	0	0	150,000
27.	Adel	August 10	1:00 p. m.	sw. to ne.	1 mile	0	0	0
28.	Albia	August 10	2:00 p. m.	nw. to se.	1½ miles	0	0	500
29.	Manchester	September 8	4:00 p. m.	sw. to ne.	1½ miles	6	0	25,000
		September 8	8:00 p. m.	sw. to ne.	7 miles	0	0	13,000
	Total				114 miles	27	3	$ 313,850

COMPARATIVE DATA FOR THE STATE—Annual

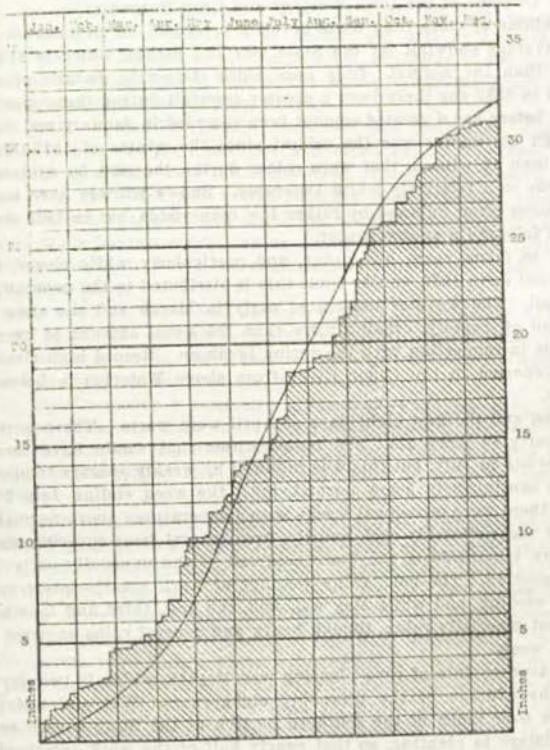
Year	Temperature: Mean annual	Highest	Date	Lowest	Date	Precipitation in Inches: Annual	Greatest annual	Latest annual	Average snowfall
1873	46.1	102	August 31	—38		33.92	41.04	23.34	
1874	47.7	101	July 5	—24	January 24	30.76	39.76	23.43	
1875	43.3	97	July 16	—31	January 14	35.83	48.42	28.55	
1876	45.9	96	August 24	—28	December 9	26.65	53.57	19.92	
1877	48.4	100		—31	January 8	35.16	49.82	22.52	
1878	50.0	104		—13	January 6	34.53	42.08	20.92	
1879	48.0	102		—35	December 25	28.23	46.71	16.49	
1880	47.9	104		—25	December 27	30.95	51.10	14.90	
1881	47.5	104		—40	January 9	44.16	56.81	34.02	
1882	48.4	98		—23	December 7	33.40	50.30	17.71	
1883	44.8	100		—38		34.54	46.15	18.00	
1884	46.0	96		—38	January 5	35.59	46.60	23.35	
1885	44.7	102	July 30	—42	January 28	32.23	44.89	17.91	
1886	46.4	103	July 13	—34	February 4	24.71	35.48	15.55	
1887	46.6	105	July 29	—34	January 7	26.31	38.61	12.30	
1888	45.3	110	August 2	—43	January 15	31.44	41.17	20.60	
1889	48.0	104	August 30	—28	February 23	24.95	37.61	13.66	
1890	47.5	110	July* 13	—27	January 22	29.48	45.45	16.54	
1891	47.3	106	August 9	—31	February 4	32.90	49.05	23.48	
1892	46.6	104	July 11	—38	January 19	36.58	48.77	24.78	34.2
1893	45.7	102	July* 13	—36	January 14	27.59	33.27	19.19	37.4
1894	49.7	109	July 26	—37	January 25	21.94	29.81	15.65	19.2
1895	47.2	104	May 28	—33	February 1	26.77	35.25	18.57	26.0
1896	48.6	104	July 3	—20	January 4	37.23	51.60	28.68	22.6
1897	47.8	105	July* 23	—30	January 25	26.98	36.18	20.21	38.8
1898	47.7	103	August 20	—25	December 31	31.34	55.47	19.51	40.3
1899	47.3	104	Sept. 6	—40	February 11	28.68	42.06	21.79	23.4
1900	49.3	103	August 3	—27	February 15	35.65	47.33	25.05	25.8
1901	49.0	113	July 22	—31	December 15	24.41	37.69	16.35	38.5
1902	47.7	98	July 30	—41	January 27	43.82	58.80	20.14	28.0
1903	47.2	101	August 24	—27	December 13	35.39	50.53	26.41	19.4
1904	46.3	100	July 17	—32	January 27	28.51	38.93	19.34	29.2
1905	47.2	104	August 11	—41	February* 2	36.56	52.26	24.66	38.3
1906	48.4	102	July 21	—32	February 10	31.60	44.34	20.63	22.3
1907	47.4	102	July 5	—31	February 5	31.61	43.90	19.93	24.9
1908	49.4	101	August 3	—18	January 29	35.09	49.98	24.11	22.7
1909	47.4	103	August* 15	—26	February* 15	40.01	53.48	37.20	49.0
1910	48.6	108	July 16	—35	January 7	19.87	27.99	12.11	23.4
1911	49.5	111	July* 3	—35	January 3	31.37	46.77	19.74	35.3
1912	46.3	104	Sept. 8	—47	January 12	28.65	33.13	15.25	39.5
1913	49.7	108	July* 16	—25	January 8	29.95	45.18	20.31	25.4
1914	49.1	109	July 12	—31	December 26	31.93	44.11	22.30	27.5
1915	47.8	99	May 14	—32	January 28	39.53	51.15	27.29	31.3
1916	47.2	106	August 4	—34	January 13	28.90	46.34	22.48	29.5
1917	44.8	106	July 30	—40	December 29	27.81	36.00	20.78	32.4
1918	49.2	113	August 4	—36	February 4	32.78	47.53	25.03	33.4
1919	48.6	104	July* 30	—36	December 10	36.76	48.16	26.88	26.6
1920	48.2	102	July 23	—26	January* 4	31.75	44.00	20.95	21.7
1921	52.2	104	July* 11	—22	December 25	32.03	46.47	20.44	30.7
1922	50.2	104	June 23	—29	January 6	29.98	44.20	19.08	13.5
1923	49.0	102	July* 22	—23	February* 3	29.50	37.47	21.36	36.3
1924	46.4	100	August* 21	—36	January 5	31.39	43.85	19.41	37.2
1925	48.8	105	July* 1	—25	December 29	28.24	45.53	13.77	29.2
1926	48.3	109	July* 19	—22	January 28	33.07	48.36	22.35	27.8
1927	48.8	102	July 11	—27	January 15	29.35	47.54	18.75	17.9
1928	49.4	100	August 1	—30	January 2	35.96	47.81	24.67	22.5
1929	46.4	102	August 22	—35	February 20	30.20	44.24	20.57	41.8
M'n	47.7					31.82			29.8

*And other dates.

PRECIPITATION

DES MOINES, IOWA

Line bounding shaded area shows accumulated depth in inches, 1929. Smooth curve shows normal.



Total for 1929, 31.01. Normal, 32.04

WEATHER AND CROP REVIEW, 1929

(In the preparation of this review and summary the Weather Bureau and Bureau of Agricultural Economics of the U. S. Department of Agriculture, co-operated with the Weather and Crop Bureau of the Iowa Department of Agriculture. Read at the Iowa Annual Agricultural Convention, House Chamber, State Capitol Building, Des Moines, Iowa, by Charles D. Reed, Director of the Iowa Weather and Crop Bureau.)

A winter of more than usual severity preceded the crop season of 1929. The average snowfall for the State was 32.3 inches, which is 11.6 inches more than the normal. Only once since state-wide records of snowfall began in 1892 has there been a greater snowfall during these months, and never before has a greater amount been recorded in January and February. Though the winter was the coldest since the winter of 1917-1918, there have been 14 winters that were colder during the past 56 winters. This was due to a relatively warm December. Snowy winters have heretofore been most often followed by rather low corn yields, but in 1929 good corn yields followed a snowy winter.

Not in many years has clover, and particularly white clover, been so luxuriant as in 1929, and by some this is attributed to the generally heavy snowfall. The weather moderated early in March and the snow melted and ran off rapidly, causing more than the usual amount of overflow of streams in connection with the spring break-up. Record high river stages were reported in the Cedar River from above Waterloo to below Cedar Rapids.

March and the first eight days of April were warm. There were a few days early in April that had temperatures that would have been more appropriate in July, but this was followed by weekly average temperatures almost continuously below normal, until the week ending July 23, after which there were occasional weeks with temperatures above normal. September was noticeably cool, and the first general frost covering about the northern two-thirds of the State occurred at the unusually early date of September 18. The cold, rainy weather of April greatly interfered with spring seeding, and while May was cold, the first, third and fourth weeks were not especially rainy, though heavy and general rains occurred in the second week.

The average date of corn planting was May 16, which is two days later than the average of the preceding eight years. Wet and unfavorable weather over much of the southern portion of the State caused very unusual delays in planting, so that nearly half of the work remained to be done in some counties at the close of May. The progress and condition of the crop through the early part of the season was unusually variable. By July 1 the tallest corn was shoulder high in several localities, and about one-third of the acreage of the State was knee high, while in the southern counties the crop averaged two weeks late, and in wet areas the fields were very weedy. By August 1, 75% of the corn had silked, which is about three days later than usual. Good rains during the first half of July and the first week in August, furnished ample moisture to bring the corn through, though at times during the latter half of July, and most of August, the drouth was serious in large areas and threatened to damage the crop considerably. After the widespread frost of September 18, there were very few damaging frosts till late in October, which permitted the belated corn in southern Iowa to gain a maturity that seemed impossible at the close of September. The month of October can do much to spoil a good corn crop or bring a belated one through. This year our correspondents showed a noticeable increase in the yield per acre on November 1 as a result of the favorable weather in October, and their optimism was maintained in the reports of December 1 after 88% of the corn had been husked, resulting in an estimate of 40 bushels per acre as the average yield, which was the highest of all the monthly estimates of the season, except August 1, which was a half bushel higher. For the State as a whole, 85% of the corn escaped frost damage.

The cool, moist, springtime, which continued into early July, was exceptionally favorable for hay, pastures and small grain. The first and second cuttings of alfalfa were unusually good, though later drouth was unfavorable, and the third and fourth cuttings were generally omitted. Small grain harvest was later than usual, and the slacking up of the rains after July 15 made harvest conditions unusually favorable except that the high humidity and heat toward the close of July killed many horses and was very hard on men.

Not in many years has there been as much activity in cutting and hulling red clover for seed. The acreage harvested for seed this year is more than three times as large as in 1928, and we believe that our estimate of 114,000 acres is under rather than over the true amount.

Based on the December 1 estimates of acreage, yield per acre, total production and price, the total value of all Iowa crops in the year 1929 is placed at $579,841,000, and it is gratifying to note that there has been a steady and uninterrupted rise in the total value of crops during the past four years.

The total production of corn is placed at 437,760,000 bushels, which, at the December 1 farm price of 70c per bushel, would give a total of $306,432,000. This total production is 27,000,000 bushels less than the final revision of the 1928 crop, and according to the usual rule, should have been valued at more dollars than the 1928 crop. There are reasons for believing that the price of 70c per bushel is somewhat lower than it should be, considering the total United States crop which is somewhat deficient. It seems probable that recent financial difficulties in the east may have had some effect on this price. With Iowa far above all other states in corn production this year, and the other states generally deficient as compared with their past record, there seems to be no good reason why the price of corn should remain as low as it is at the present time, for very long. Of course the usual seasonal rush to market during the next 90 days will prevent any large rise in price, but there is little doubt that corn holding will be a better proposition than corn selling from this time on until about March.

Oats, which are Iowa's next largest and most valuable crop, occupied 5,944,000 acres, yielding 37 bushels per acre, or a total of 219,928,000 bushels, which, at 39c per bushel December 1, are valued at $85,772,000. In this

case 11,000,000 less bushels of oats than in 1928 were worth about 3,000,000 more dollars.

Iowa's next largest crop is tame hay, to which 3,286,000 acres were devoted in 1929, giving an average yield of 1.93 tons per acre, or a total production of 6,342,000 tons, which, at a price of $11.00 per ton December 1, makes the total value of the tame hay crop $69,762,000. This is the largest number of tons of tame hay that Iowa has raised since 1908.

The next most valuable crop is pasture and grazing, the value of which in 1929 is estimated at $61,240,000.

Potatoes, in 1929, are a striking illustration of decreased production resulting in greater valuation. It is estimated that 75,000 acres of potatoes were raised, yielding 102 bushels per acre, or a total of 7,650,000 bushels. At the price December 1 of $1.40 per bushel, the total value of the crop is estimated at $10,710,000. In this case, a crop amounting to 3,285,000 less bushels is worth nearly twice as many dollars. This, however, is accentuated by the fact that long continued drouth and heat in the potato States to the northward reduced the crop in that section to an unusually low figure.

In recent years barley has shown a great expansion, but in 1929 the acreage was 642,000, which is 160,000 less than in 1928. With the yield per acre at 30.5 bushels, which is less than in 1928, the total production was 19,581,000 bushels. At the December 1 price of 52c, the total estimated value of this crop is $10,182,000.

Practically all minor crops showed increases in total production or value as compared with 1928.

Bulletin No. 1, April 9, 1929—

Warm, dry, sunny weather in March rapidly melted the unusual quantity of snow that accumulated in January and February. January and February were notably cold. At the close of March frost had left the surface soil in most of the State, but remained in the subsoil, keeping the surface too wet for field work, except on highlands and in some localities where the winter snows were light, particularly in the northwest counties.

During the last two days of March a heavy snowstorm passed over the northern half of the State, accumulating a depth of 12 inches in some places, and stopping traffic. In the northeastern portion of the State there was a heavy deposit of glaze that demolished wire, poles and trees. Tornadoes occurred in Franklin and Linn counties on March 24.

Not for many years has the weather been so warm in the period April 1st to 9th. During the past week the average temperature, 61.1 degrees, has been 15.8 degrees above normal, with heavy rains in the northeast counties and generous showers elsewhere. Several small tornadoes occurred in northern Iowa and possibly some other sections on the 5th and 6th.

Vegetation made a wonderful advance. In the south and west counties lawns are high enough to mow and pastures are affording succulent grass for sows with young pigs and ewes with lambs. Spring seeding is more than half done in the drier southern and northwestern counties, and in a few other favored localities. The earliest oats are up and showing green as far north as Marshall county. Field work has been delayed by wet soil from the central counties north and east.

Plowing for corn has made progress where the soil is dry enough. Nearly 600 reports on seed corn testing up to April 1st show an average of 93 per cent testing strong.

Winter wheat wintered in good condition generally, but in some localities recent gales blew the soil away from the roots in places and covered the plants in other places. Some winterkilling is reported in Decatur county.

Apricots, peaches and pears are in bloom in the southern counties, apple buds are showing pink and ready for first spray, and plums nearly ready to open. Cherries are in bloom in Lee county. Rabbits seriously damaged young fruit trees in many southern counties during the winter.

Bulletin No. 2, April 16, 1929—

General rains at the beginning of the week and temperatures averaging 3.8 degrees below normal, with freezing almost every night in the northern counties, and in nearly all portions of the state on the 12th and 13th, retarded the progress of vegetation and delayed field work. The lowest temperature reported was 19 at Inwood, on the 12th.

Oats seeding has been nearly completed in the extreme southern counties but not more than 25 to 50 per cent has been done in the central and northward and eastward, where the soil is wet and saturated to great depths, and only the higher tile drained fields can be worked. Early seeded oats are up and the fields are green. Early barley is also up, but there are some reports of decreased acreage.

Plowing for corn has made rather poor progress, due to the water-logged soil. Unless abnormally dry weather follows, corn planting will be late. Reports on tests of seed corn continue good. A little corn husking remains to be done in the southcentral counties.

Winter wheat, grasses, clovers and alfalfa made fair growth and are in good condition generally. Considerable grass and clover seed has been sown and the moist soil has been favorable for germination.

Though fruit blossoms were open to a considerable extent in the southern counties, it is believed that they were not materially injured by the recent freezes, except possibly on the lower lands. In the north half of the State, the nightly freezes beneficially retarded the development of fruit buds which were about to open too early for safety. Considerable gardening and potato planting has been done.

Spring chicks are later than usual and the wet weather has not been favorable for young pigs.

Bulletin No. 3, April 23, 1929—

Heavy rains in the southern counties, frequent showers elsewhere, deficient sunshine, and persistent coolness, with occasional frosts and freezes, made the past week generally unfavorable.

Oats seeding made slow progress. Much broadcast seed lies on the ground uncovered because the ground is too wet to work, and much has been "mudded in." Nearly half the intended acreage has not yet been seeded in the northeast one-fourth of the State, while in the southern counties that got an unusually early start, not much progress has been made for nearly a month. Early seeded oats are making fair growth, but would be benefited by warmth and sunshine.

Almost no progress has been made in preparations for corn planting except in the drier west central and northwest counties. Lowlands were generally flooded by the heavy rains in the southeastern district. Drier weather must come soon to prevent a repetition of the belated corn planting of 1927.

Winter wheat and grasses are making fair growth, but need warmth and sunshine. Pastures are affording considerable grazing somewhat earlier than usual. Considerable alfalfa and sweet clover is being seeded with the oats.

Reports on spring pigs are rather adverse. Sows that had the flu are losing their pigs. The hatch of chicks is relatively small and late due to infertile eggs.

Plums and cherries are in bloom as far north as central Iowa somewhat earlier than usual, and therefore in danger of damage by frost. Conditions are not favorable for pollination. In northern Iowa fruit

blooms have been beneficially retarded by the cool cloudy weather. Strawberries mostly wintered well. They are in bloom in Lee county.

Bulletin No. 4, April 30, 1929—

Another cool, cloudy, rainy week further delayed oats and barley seeding and stopped all preparations for corn planting except a little in some of the drier uplands of the west central and northwest counties. Rainfall of one to more than three inches occurred in all sections of the State. Heavy frosts and freezes were reported in many sections on the 29th.

As much as 35 per cent of the oats seeding remains to be done in some south central and northeast counties. Considerable intended oats acreage will not be seeded as it is getting too late. Some of this acreage will be put in barley which can stand a little later seeding, and some will be put in soybeans or possibly in corn if the soil dries in time for corn planting. In many localities there is a noticeable amount of last year's corn still unhusked in the fields, due to the early, heavy and persistent snows, and the wet and impassible fields this spring. Early seeded oats are making fair growth.

Not a furrow has been plowed in many localities in preparation for corn planting, due to the supersaturated fields. Tile drains running to capacity are inadequate to remove the surplus water. In only a few northwest counties is there a prospect for corn planting to begin on nearly the normal date. Strangely enough, a little corn planting has been done in Marshall county.

Winter wheat is yellow from excess moisture in many localities. Grasses, alfalfa and sweet clover are making fair growth.

Fruits are blooming very irregularly in central and southern Iowa, with unfavorable conditions for pollination, but probably no great damage from recent frosts and freezes.

Bulletin No. 5, May 7, 1929—

Nearly rainless weather, April 29 to May 5 inclusive, and only light scattered showers since, with considerable wind and nearly normal sunshine, dried the water-logged soil rapidly, so that field work made good progress. Temperatures were abnormally low, with frost and freezes almost every night. Ice formed, ranging from one-half inch thick in the northwest counties to the thickness of window glass in the southern counties. Horses needed the low temperatures to endure the hard work of catching up with the belated field operations. The soil is heavy, sticky and very hard to work. Great care will be necessary to prevent clods. Only in some west central and northwest counties is the soil in good tilth. Much lowland acreage cannot be touched yet. Field work and vegetation are about two weeks late.

Belated oats seeding continues in the northern and eastern districts, and some reseeding is being done in the southern counties where the seed has rotted. Oats that are up have not made good growth the past week, due to the persistent cool, frosty weather. Considerable intended oats acreage will go into soybeans in the southern counties, and corn in the northern counties.

A little corn planting has been done on uplands in nearly all sections of the State, and a little corn is up in Mahaska county, but the soil is too cold for good germination.

Winter wheat, meadows and pastures made slow growth. Potatoes were frozen off; tomatoes killed; and gardens given a general set-back. Strawberries were considerably damaged by the freezes. The fruit seems to have stood the freezes fairly well, though damage in localities, and conditions have been unfavorable for pollination. Bees are noticeably absent, due to extensive winter killing.

Bulletin No. 6, May 14, 1929—

Dry, cool weather, with occasional frosts and freeze, continued till the 9th in the extreme western counties, and till the 11th in the extreme southeast. Field work was pushed vigorously. In some cases tractors worked day and night, equipped with lights, in a frantic effort to catch up with the belated work. About half of the spring plowing turned up glazed and favorable for baking into tough clods. Fall plowing works up better. Moderate rains in the extreme western and southeastern counties will help dissolve the clods, but excessive rains Friday night over half the area of the State, mostly in the central and north-central counties, will add greatly to the difficulties and delay in corn planting and preparations therefor.

When corn planting was stopped by the rains, between the 9th and the 11th, the amount of planting done for the State as a whole, averaged 32 per cent, ranging from none in some counties to 65 per cent in Hamilton and Plymouth counties. Very little planting could be resumed up to Tuesday morning, when this is being written, and further rains Monday night will cause further delay. On this date, in the past 10 years, about 48 per cent of the corn has been planted, so planting is about 26 per cent below normal, or about 8 days behind. Each one-sixth of an inch of rain delays planting about one day.

Small grains and grasses have made slow growth, due to the persistent coolness and cloudiness, and small grain is yellow in many wet fields. There are large patches in many fields that could not be seeded and will produce only weeds. Winter wheat is showing heads in Iowa county.

Gardens and potatoes are slow. Potatoes in the ground a month are not up. Tree fruits show evidence of poor pollination.

Bulletin No. 7, May 21, 1929—

With little or no rain and continued low temperature, field work made rapid progress, except in the wetter southwest and south central counties. Much wind dried the soil rapidly but baked it into hard clods. On the 15th the wind was so strong as to stop field work in places. There were frequent frosts. The most severe and general was on the 16th, but only strawberries and tender garden truck were damaged. The steady coolness, with frequent and mostly moderate frosts, has hardened vegetation and given it an unusual immunity from frost damage.

Corn planting averaged 57% completed at the time the correspondents' reports left the farms, which averaged about the 20th. This is about 13% below normal for that date, and about four days later than normal, indicating that the work caught up four days during the favorable weather of the week. Planting is farthest advanced in the northwest and east-central districts, where some counties report 90% done, while in some south central counties only 5% to 10% has been planted and most of the plowing remains to be done. The ground is difficult to work and the cost of preparations for corn planting is easily double that of last year, and the work is not nearly so well done. Practically no replanting was necessary last year, when at this date nearly all was planted, most was up, and a little was cultivated. The average temperature of the last week, 53.1 degree, was too cool for germination. Very little corn is up yet, considerable seed has rotted, and much replanting will be necessary.

Small grains and grasses made slow growth and grains look yellow from frequent freezes and water-logged soil, which is now baking on the surface.

Bulletin No. 8, May 28, 1929—

With little or no rain in the northwest district, and moderate showers elsewhere, except rather heavy in the north-central district, with temperatures averaging above normal for the first week in seven, and with abundant sunshine, the past week was ideal for farm work and for crops except in the northwest district, where rain is needed. The showers did much to soften the clods in the cornfields and the baked surface soil in small grain and meadows.

Corn planting progressed rapidly. This work is now 83% completed for the State as a whole, which is about normal. It ranges from 100%

in most of the northwest district to as little as 20% to 30% in Ringgold and Clarke counties. Germination of recently planted corn was excellent, due to the heat and moisture of the week, except in several northwest counties, where the soil is too dry. Considerable early planted corn, amounting to 15% of the acreage in some counties, lay ungerminated in the cold, wet soil for two or three weeks, and rotted or was devoured by insects or other enemies and has been or will be replanted. The corn is up now and shows rows in probably one-third of the acreage planted. Considerable has been cultivated with rotary hoes and weeders or blind plowed. In uncultivated fields the weeds got a good start this week.

Oats, barley, winter wheat and other small grains, improved under the favorable temperature and moisture conditions. Oats vary in height from just up in some northeast counties to well stooled and covering the ground in other counties. Considerable barley was sown late.

Fruit conditions are variable. Apples are mostly good but other tree fruits did not set on well. Strawberries have been greatly damaged by frost in some sections. Gardens made good growth the past week. The frost of May 21 will probably be the last of the spring.

(Since the above was written, telegrams received, show good rains in the extreme northwest counties Monday night.)

Bulletin No. 9, June 4, 1929—

Warm weather continued well into the week but it turned decidedly cooler on June 1 so the average temperature of the week, 64.6 degrees, is 0.7 degrees below normal. Sunshine was deficient. Showers or rain were frequent, almost daily in some southern counties, reaching a total of over 4 inches in Decatur county. In several east central and northeast counties the rain was light and more is needed. The northwest counties that had been dry for several weeks were pretty well soaked and in some localities the rain was damaging. Tornadoes were reported in Lyon and Cherokee counties, but the damage was small.

Corn planting and replanting made good progress in spite of the rains and is nearly completed, except in the extreme south central counties, where about 20% remains to be done. The stand is fair to good in most of the State, though poor in localities, and not nearly so good generally as last year. Some wet lowland acreage in southwest Iowa will not be planted to corn but will be put to soybeans or catch crops, if farmed at all. Perhaps half of the corn has been cultivated once and a little twice. Uncultivated fields are getting green with weeds.

Oats, barley and winter wheat made good progress in most of the State, but still look yellow on low water-logged ground.

Strawberries are going to market and turning out well in the principal commercial area in Lee county and promise fairly good in some other sections, but there was considerable damage by the frequent frosts in May.

Some alfalfa has been cut and the crop looks well generally, as do all hay crops. Red clover is beginning to bloom. Pastures are good. There have been an unusual number of complaints in the last few weeks of cattle dying from sweet clover bloat.

A decided drop in the price of corn and small grains during the week has abruptly checked the flow to market.

Bulletin No. 10, June 11, 1929—

Well distributed showers occurred in nearly all portions of the State, except a few northeast counties where rain is now badly needed. The rains were beneficial, except in several wet, backward southern counties, where they caused further delay and difficulty in spring plowing and planting. Cool weather, especially cool nights, continued till the 9th, when it turned much warmer.

Corn made fair to good progress generally. In the more advanced central and northwestern counties, most of it has been cultivated once, considerable twice, and the average height is about four inches. But in many southern counties a considerable acreage has continued wet and

soggy, so it is being plowed with great difficulty; and some plowing, and in localities 20% of the planting remains to be done. In the dry northeast counties the corn is waiting for rain to germinate it and the delay is exposing the seed to the depredations of insects, squirrels and birds. The stand will not be nearly so good as last year, and the advance of the crop is unusually irregular. Corn fields are getting weedy where rains have prevented field work.

Oats, barley, winter wheat and other small grains, have made good progress and are generally in good condition, except where rain is needed in the dry northeast counties and on wet lowlands where the plants look yellow. Winter wheat is heading northward as far as Woodbury county.

Hay crops are making a heavy growth generally. Alfalfa cutting is getting under way slowly. Some that has been cut was damaged in the windrow by frequent, heavy showers.

The June drop of apples has been rather heavy, yet enough remain for a good crop. Cherries and plums dropped early and the outlook is not very good. Strawberries are beginning to ripen in the central counties, and are drying up for lack of rain in the northeast counties. There are many complaints of damage from the persistent spring frosts.

Loss of cattle from clover bloat continues and extends to all kinds of clovers. There has been a good flow of honey from white clover.

Bulletin No. 11, June 18, 1929—

Cool weather at the beginning of the week, followed by much warmer, resulted in a weekly average temperature one degree above normal for the State. This is only the third week out of 11 this crop season with temperatures above normal. Rainfall was heavy to excessive in most of the Mississippi River counties, and in the extreme western counties from Lyon south to Monona, bunt elsewhere little or no rain fell. The high southerly winds and afternoon temperatures in the 90's rapidly evaporated the moisture, and good rains are needed.

In the early morning of June 11, destructive hail and wind storms occurred in many localities north and east of Des Moines, and between 8:00 p. m. and 10:00 p. m. of that date two very destructive hail storms moved from South Dakota into Iowa. One covered the southern townships of Lyon and the northern townships of Sioux counties and extended into O'Brien County, and is said to be the worst in the memory of the oldest inhabitants. In Sioux Township, Sioux County, the damage is estimated at $100,000, and several townships report damage of $30,000 to $50,000. The other storm struck the northern townships of Woodbury County. Severe hail also occurred near Onawa, Monona County, on the 17th. Hailstones as large as 2 inches in diameter were reported, breaking through roofs of houses and automobiles and killing and injuring livestock. So far as known at this time the winds were squall winds and not tornadoes, but they had sufficient strength to uproot many trees, demolish buildings and break down poles and wires.

The progress and condition of corn is exceedingly variable. Some is a foot high, some has not yet germinated, and some ground intended for corn is yet to plant in the south-central and southwest counties. A large acreage in the northern half of the State has been seriously damaged by hail. This may recover but will be late. Cultivation made good progress generally, and not many fields are weedy.

Oats are shooting and beginning to head in some localities. Barley is beginning to head. Winter wheat is practically all headed and filling nicely. Hailed areas of small grains will probably not recover.

Much alfalfa and red clover hay was cut this week. Yields are heavy, but rank growth makes hay a little coarse. The strong winds and high temperatures were favorable for curing, though some was damaged in the rain areas.

Bulletin No. 12, June 25, 1929—

Temperatures averaged slightly below normal the past week. There was no rain of agricultural importance except in a few southern and eastern

counties. The drouth is becoming serious over much of the State. The rainfall June 1st to 25th averages 67% of normal, and ranges from less than 25% in several north-central and northeast counties to excessive amounts, exceeding 150% in portions of Woodbury and Plymouth counties. In the extreme southern counties it has been normal or slightly above. In about half of the State large cracks are opening in the ground in meadows, pastures, small grain and other uncultivated ground.

Corn made good progress but, of course, lacks much of being up to normal in the backward southern counties. In the more advanced localities in the central and northwest counties it is already more than knee high. The average for the State is slightly less than a foot. The generally dry weather has been favorable for cultivation and weed killing. Not much of the hailed corn in the northwest counties will recover. Hundreds of acres have been disked and planted to short maturing varieties or fodder corn. Considerable has been flooded out in these counties, and the ground is too wet to replant. Persistent rains in some southwest counties prevent cultivation and fields are getting weedy.

Oats are in the critical heading stage and are very short on account of drouth. A good rain within a week might not be too late, especially for late oats, but early oats have been injured and for those hailed out June 11, there is not much hope.

Winter wheat is also in the critical filling stage and is being injured in the dry counties. However, most of the acreage is in counties that have ample moisture. Barley is doing fairly well but is also heading and needs rain.

Much red clover and alfalfa has been cut for hay, with unusually favorable conditions for curing in most of the State. The yield and quality is excellent. Early cut alfalfa in some cases shows a second growth of 10 inches. The season has been unusually favorable for white clover, which has made a luxuriant growth. Considerable bluegrass seed has been stripped. Pastures deteriorated considerably for lack of rain.

Strawberries dried up in the northern half of the State. Currants are ripening and yielding well. Raspberries and blackberries are doing well but would be benefited by rain. Early cherries are yielding better than expected.

Bulletin No. 13, July 2, 1929—

Frequent, well distributed rains, with temperatures averaging about normal, and ample sunshine, made the week favorable for crops, except in some localities damaged by hail and excessive downpours of rain. Rainfalls exceeding two inches occurred in portions of Woodbury, Plymouth and eastward over Buena Vista and Carroll counties. Most of this area already had too much rain. The rainfall of June at Sioux City was 8.47 inches, making it the wettest June in 40 years. In contrast, the rainfall at Waterloo in June was only 1.00 inch, or 24% of normal. Another wet area the past week extended from Benton County southeast over Clinton, Scott and Muscatine counties, where it exceeded 2.50 inches at several stations.

Corn made very good to excellent progress generally. The tallest is shoulder high in several localities; about one-third of the acreage is knee high; and some has been laid by in most of the counties. In many counties the latest is not more than two inches high. In the southern counties the crop averages two weeks late, while in the nortwest counties it is fully up to normal. The crop is well cultivated except in the wet area around Sioux City, where it is weedy.

Oats are very uneven in height, stand and general condition, but the rains of the past week will be of great benefit to the bulk of the crop, which will yet be able to fill and develop considerably. A little has begun to turn. Winter wheat is turning in most of the areas where it is raised, and the general condition is good, though later than usual. Barley is not as uneven as oats. It is heading and filling nicely.

Cutting of the heavy clover crop continued but the rains caused difficulty and damage in curing. Most of the first cutting of alfalfa has been completed. The growth of white clover has been unusually luxuriant, affording much good bee pasture. Linden was in full bloom the past week, also keeping the bees busy. Pastures were much improved by the rains.

Some localities are reporting such a heavy June drop of apples that very few are left to mature.

Bulletin No. 14, July 9, 1929—

All portions of the State received rain during the past week but the amounts varied from light in most of the northern half of the State to heavy in the southern half and excessive in portions of Fremont and Page counties. Heavy rains visited the southeast counties along the Mississippi River on the 8th. Temperature averaged slightly below normal, humidity above normal and sunshine considerably deficient.

Corn made good growth, fields are generally clean and well cultivated, about one-fourth has been laid by or is too tall to cultivate, and considerable is only a few inches tall.

Winter wheat is ripe and ready to cut generally, and cutting has begun as far north as Benton and Woodbury counties. It has filled well and is in good condition generally except in portions of Monona, Woodbury, Page and Fremont counties, where it has been flooded. Black rust is reported in Monona County, which has become the leading winter wheat county. Rye is ripe and being cut in localities. Barley and early oats are turning. Late oats are green and were greatly benefited by recent rains and moderate temperatures but the oats crop in general is rather uneven and considerable has headed short.

Haying was delayed and considerable hay was damaged by the rains in the southern counties. All hay crops are the heaviest in years. There are reports of red clover yielding two tons per acre and alfalfa three tons. Second growth alfalfa is about a foot high and will soon be ready to cut.

Raspberries and blackberries were benefited by the rains, though in some areas the rains came too late or were insufficient. Early potatoes have set on well and promise a good crop. Pastures have made rank growth and in some cases are understocked.

Bulletin No. 15, July 16, 1929—

Rains of the week were heavy, averaging 1.9 inches or more than twice the normal, and well distributed except some localities where they were excessive, particularly in the extreme southwest counties where many bridges were swept away and the erosion of the soil constitutes a great loss, estimated on some farms at $1,000 per farm, besides considerable loss of livestock and shocked grain. The rains were of great benefit in the drier central and northern portions of the State. Damaging hail and wind squalls were reported from many localities on the 12th-14th. Temperatures at the beginning of the week, though not unusually high, were oppressive, due to the high humidity, and cooler weather toward the close of the week made the average temperature 1.2 degrees below normal. Of the 15 weeks since April 1, only three have averaged warmer than normal.

Corn made good progress and has a good color generally. The bulk of the crop is too tall to cultivate, though in nearly every county there are late fields that can be cultivated for two weeks. The earliest is showing tassels in many counties. Wind squalls blew down considerable corn and some has been overflowed in the southwest counties, but most of this will recover.

Considerable oats, barley and winter wheat were beaten down by the heavy rains and wind, and this is making harvesting difficult. Winter wheat is practically all harvested in the south half of the State. A good beginning has been made in harvesting early oats. The recent cool weather, with ample moisture, has helped small grain to fill. Rust, smut and other diseases are less prevalent than usual, so the grains are plump and of good quality, and good yields are indicated. Where alfalfa and sweet clover were sown with small grains, and combines are used, the grain is being

put in windrows to dry. Much shocked grain was washed away by floods in the southwest counties.

Haying has been brought to a halt by the recent heavy rains which damaged considerable that was still out after being cut. In southern Iowa the first cutting was mostly done early, and the yield and quality is the best in years. Where cut early the second growth is rank and clover is again in blossom in places. As many as five loads per acre of alfalfa have been reported from the first cutting. There are reports that the south-central counties will return to the production of timothy seed which they nearly abandoned last year.

Bulletin No. 16, July 23, 1929—

Dry, cool, sunny weather prevailed, except some showers in the northwestern counties, and temperatures in the 90's over much of the State on the afternoons of the 21st and 22d. The soil dried rapidly and some localities are already needing rain.

With ideal harvest weather about all of the barley and most of the early oats have been cut, except in the extreme northern counties. Late oats harvest is beginning in the central counties and all harvesting is nearly finished in the southern counties. Threshing has started in a few localities. Red rust showed up in considerable quantity this week, due, it is said, to calm, foggy mornings. Late cuttings of clover and timothy and second cutting of alfalfa made good progress, with mostly good conditions for curing. Not in many years has the quantity and quality of the hay crop been so good.

Corn made good progress. Much is now tasseled, ears are shooting and silks beginning to show. A little can still be cultivated. The color is generally excellent.

Truck crops and gardens are in unusually good condition. Early potatoes are yielding well. Garden tomatoes are beginning to ripen and commercial tomatoes are thrifty. Grape vines are loaded. Pastures are unusually good for July.

Bulletin No. 17, July 30, 1929—

Hot weather, the hottest of the season, prevailed the past week, with temperatures well up in the 90's nearly every afternoon and warm nights. The State average temperature was 79.2 degrees or 5.2 degrees above normal. This makes only four weeks out of 17 since April 1 with temperatures above normal. Excepting an area about 25 miles wide from Cass to Story counties where heavy rains occurred on the 25th, small areas in the far northern counties, and heavy rain at Lamoni on the night of the 29th, 30th, there was no rain of agricultural importance. Sunshine averaged 80% of the possible, or 7% above normal.

Harvest is generally finished except late oats, in the northern counties, and these have been ripened prematurely by the heat. The heat was very hard on men and horses. Horses died by the score in the harvest fields in the northern half of the State, and rendering plants were kept busy. Harvest and threshing by combine and tractor is becoming more popular. The generally dry weather of the last two weeks has been favorable. Threshing is progressing rapidly in the south half of the State and getting well under way in the north. Yields of wheat and early oats so far reported are slightly above the 10-year average and barley about average.

The hot wave struck most of the corn at the critical silking and pollination stage. The leaves rolled badly nearly every day, and some firing is reported. It is impossible to estimate the damage but in the light of past experience, such heat, with deficient moisture, can hardly fail to reduce the yield some. Some late corn is only waist high and not yet tasseled. Army worms are reported in several localities in the northwest counties. They are causing total destruction in occasional fields, but the total acreage affected is not large. Pastures are beginning to turn brown. As yet potatoes in Iowa have not been seriously injured, and it is well, since the great potato regions of Minnesota, North Dakota and Montana are facing a potato failure as a result of about 10 days with temperatures of 100 to 106. Blackberries are drying up in places on account of the heat and drouth. Flies are becoming troublesome to livestock. Hog cholera is breaking out in many places but will probably not become epidemic due to general vaccination of shoats.

Bulletin No. 18, August 6, 1929—

Rains of August 1st-2d and 4th-5th were of great benefit over large areas, though insufficient to break the drouth in much of the south one-third of the State, while in the valley of the Iowa River and eastward to the Mississippi considerable areas were damaged by floods. The heaviest rain reported was 8.27 inches in about four hours at Toledo, Tama County. This is nearly twice as great as has ever been recorded in any 24-hour period at that station in the last 35 years and is about one-fourth of the annual normal. Other excessive and unprecedented amounts reported were Luzerne, 7.05, and Belle Plaine, 6.33. Marshalltown had 4.97 and Tipton, 4.40. Temperatures were moderate and sunshine deficient.

The heat and drouth menace to the corn crop was largely averted, except in several southern counties and in portions of the west central district, and in a few other localities where a return of high temperatures, without more rain, would be serious. The favorable conditions of the first half of July were to some extent offset by the unfavorable conditions toward the close of the month, but is probable that the general condition of corn in Iowa now is about the average of the last 10 years. It could hardly be called a "bumper crop." The advance of the crop is about normal, the bulk being between the "blister stage" and roasting ears. Only the earliest has reached the roasting ear stage, while the latest is just beginning to tassel. Sweet corn was more seriously affected by the heat and drouth than field corn.

Harvest is finished except late, hailed areas and some wet areas in Monona County. Threshing progressed rapidly except where it was halted in the area of heavy rains. Yield and quality are unusually spotted and variable but the average will probably be close to that of the last 10 years.

Second crop alfalfa has mostly been cut, with excellent yields, and the third crop is in many cases 10 inches high. Second crop timothy and clover are making good growth. Pastures are good. Potatoes were much relieved by the rains and lower temperatures. The cucumber pickle crop was hard hit by the heat and drouth in southeast Iowa and may not recover. Commercial and other tomatoes are doing well.

Bulletin No. 19, August 13, 1929—

Cool weather at the beginning of the week was followed by rising temperature, reaching well up in the 90's at the last. Little or no rain occurred except in a few localities, and the need for rain is becoming acute in about half of the State, mostly in the southern and western counties. Sunshine was ample, humidity high and wind light.

Threshing made good progress and ranges from finished in some southern counties to less than half done in the northern counties. Yields of oats and barley are unsually variable, ranging from very poor to very good, with quality and weight per bushel the same.

Corn made excellent progress where moisture is sufficient, but in about one-third of the State it made poor progress due to the drouth, and considerable wilting occurred during the hot afternoons toward the close of the week. The bulk of the crop is in the milk or roasting ear stage. A little has reached the glaze stage but some in the southern counties and in hailed areas is just beginning to tassel.

Fall plowing, which made a good start last week, was generally stopped by the ground becoming too hard and dry this week.

Pastures are very good for the time of year, but are generally needing

rain. Recent dry weather has been favorable for developing a crop of red clover seed. Alfalfa is making a wonderful growth for third cutting.

Serious outbreaks of hog cholera are reported in Scott County by the Eastern Iowa Veterinary Association. In some cases these outbreaks have taken whole herds. This is the season when unusual precautions must be taken to prevent the spread of cholera.

Commercial canning of tomatoes and sweet corn started in Mahaska County this week. The bean pack has been finished.

Bulletin No. 20, August 20, 1929—

After a long, nearly rainless period, very welcome rain set in during the night of August 19th-20th in central Iowa. From the southern portions of Polk, Jasper and Dallas counties, southward over Union, Clarke, Lucas and Monroe counties, only 0.75 inch to 0.82 inch of rain occurred in 25 days, which is a drouth condition seldom surpassed during the crop season. The drouth has been about equally serious in portions of Pottawattamie, Harrison, Shelby, Guthrie, Crawford and Monona counties. There has been very little rain for two weeks in many northwest and north-central counties. Moderate temperatures lessened the effects of the dry weather. Light frost was reported in spots on the morning of August 14 in Harrison, and on the morning of the 15th in Iowa and Marshall counties. Damaging hail occurred in portions of Keokuk and Jefferson, Louisa and Van Buren counties on the 12th. Sunshine averaged 83 per cent of the possible which is 13 per cent above normal.

The cool, dry, sunny weather, was ideal for threshing, which made rapid progress to completion in more than half of the counties. In some northern and extreme west-central counties, 10% to 20% of the threshing remains to be done, some of which is stacked. Except in the areas that were flooded August 1st-2d, the small grain suffered much less discoloration and damage than usual in shock.

Where soil moisture is sufficient, corn made good progress, but more than half of the State was in serious need of rain, and in about 20 counties there was actual deterioration from wilting and firing, and great damage was averted only by the cool temperature. Much of the corn is in the hard roasting ear stage and somewhat later than in the average season, only a small amount is glazing, and possibly a little in the extreme north is beginning to dent.

Reports on red clover seed average better than usual, the recent dry weather following the copious rains early in the season, being favorable; yet as usual, some localities that generally produce seed, report that the heads contain little or no seed. Timothy seed threshing is about finished, with fair yields and increased acreage over 1928, but probably not as large an acreage as the 10-year average.

Commercial tomatoes and sweet corn have seriously needed rain. The tomatoes in the markets have been somewhat reduced in quantity. Corn canning is in progress in the southern half of the State.

Bulletin No. 21, August 27, 1929—

Warm, dry, sunny weather prevailed over most of the State, though in about two-thirds of the area, mostly in the west and south, showers temporarily arrested the effects of the drouth and in areas equal to about ten counties the rain was sufficient to afford more permanent relief. The principal areas were Polk and surrounding counties, portions of Page, Taylor, Wayne and Appanoose counties, and from Lyon County southeast to the north part of Buena Vista County.

Not in several years has there been such general complaint of corn firing on ridges and uplands. The heat and drouth have hastened maturity but will probably reduce the yield to slightly less than the 10-year average. Corn is now denting generally in the northern and central counties, and in the hard dough stage in the southern counties. Husks have begun to dry on some of the earliest, while the latest is only in roasting ears. Green

corn is being fed to livestock in many places on account of the failure of pastures, which are short and brown. The milk flow has been considerably curtailed.

A remnant of threshing continues in the west-central and northwest counties. The unusually favorable weather since harvest in most of the State has resulted in an unusually fine quality of straw, which is being baled in larger quantities than usual in spite of the luxuriant hay crop that was harvested earlier in the season. There are, of course, uses for straw, for which hay is not a substitute, yet much of the straw crop generally serves as such a substitute.

Sweet corn and tomato canning is in progress at nearly all of the canneries, but both of these crops have been injured by drouth. Tomatoes will probably recover but the commercial sweet corn crop has undoubtedly been shortened so that some factories may have difficulty in filling their contracts. Late potatoes are suffering for rain everywhere, but a good general rain would still help where the tops are not dead. Plums have dried up on the trees, and apples are adversely affected. Grapes are holding their own well and an abundant crop of good quality is indicated. The melon crop has been reduced by the drouth.

Fall plowing has been greatly hindered by the dry, hard soil. Much less than usual has been done. Only high power tractors can do the job and these are in strong demand. Only in limited localities is it possible to prepare a seed bed for winter wheat. Unless general rains come soon, the acreage will be reduced from this cause.

Farm animals continue in good health generally, except that there are numerous outbreaks of hog cholera. Most of these are promptly subdued but sometimes not until whole herds have been destroyed. The drouth has had one beneficial effect in that it has produced unfavorable conditions for breeding flies, which are carriers of animal diseases, and also very annoying to livestock.

Bulletin No. 22, September 3, 1929—

High temperatures, with little or no rain, except in small scattered areas, were generally unfavorable for crops. Sunshine was 18% above normal. Hot southerly winds on Monday, September 2, were also unfavorable. In many counties the rainfall has amounted to only from one to two inches in the 50 days when rain is the principal factor in corn yield, and when the normal amount would be four or five times as large. However, the greatest shortage of rain is not in the principal corn raising portions of the State, and a good general rain would still be of great benefit, except to the earliest corn, which is sufficiently matured to save for seed. Corn on light soils has been seriously damaged.

Third crop alfalfa and second crop clover has been shortened by drouth to such an extent that much will not be cut. Pastures are drying up, and except for a generally understocked situation, would be in a serious condition. The milk supply has been reduced appreciably.

The grape crop is unusually good. One shipping point in southeast Iowa has already shipped 33 carloads of the earlier varieties, and there is yet a good crop of Concords to harvest. In some localities all of the apples have dropped from the trees, believed to be due largely to drouth. Melons are ripening rapidly and the crop has been shortened by lack of rain. Pumpkins are ripening too rapidly. Tomatoes and sweet corn have been injured.

Hog cholera has increased alarmingly, according to reports to the Eastern Iowa Veterinary Association. As there is no cure, prevention is the only hope. Millions of dollars can be saved by vaccination.

Bulletin No. 23, September 10, 1929—

After a period of belated summer heat, the weather turned decidedly cooler on September 4. The change amounted to 30 degrees or more in 24 hours. Following the cooler change came the wettest period of the crop

season. The drouth was completely relieved in most of the State, and in some of the drier south-central and southeast counties damaging downpours of rain and destructive winds occurred. A white frost was reported in Lyon County on September 5, and light frosts in several other northwest counties. Also light frost was reported from the northwest counties on the morning of the 10th.

It is believed that the rains came too late to be of material benefit to corn. The early corn was too far advanced, and the late corn too badly fired. There seems to be no doubt but what the drouth and heat reduced the yield per acre to somewhat below the average of the last 10 years. Reports received September 1 from about 850 monthly crop reporters of the combined Federal-State crop reporting service, indicated that with normal weather 56% of the corn would be safe from frost on September 20; 72%, September 30; and if frost holds off past the average date, October 5, till October 15, 88% will be safe. These figures were close to the average of such early estimates of the last 10 years. The average per cent of the corn that escaped frost in these years, as shown by reports about husking time, was 82. Silo filling is under way in several northeast counties, and a little "hogging down" has begun. A little seed has been saved.

Preparations for winter wheat seeding have been resumed since the rains, which have made possible the preparations for a good seed bed. Delayed fall plowing is now catching up rapidly. Clover seed hulling has been active recently, with yields of from one-half to two bushels per acre. The price is about $8.00 to $10.00 per bushel. Last year the production of red and alsike clover dropped to about one-third that of the preceding year. There are indications of an equally large increase in production this year to approximately the average of the last 10 years. Belated haying operations were caught by the recent rains. The late crop was reduced by the drouth. Pastures are reviving rapidly.

Hog cholera outbreaks are becoming rather alarming in several counties. Due precaution will prevent a loss of $10,000,000.

Bulletin No. 24, September 17, 1929—

Cool weather prevailed, with occasional mostly light showers, except in the northwest counties, which were dry. Frosts, mostly light, occurred on the mornings of the 10th, 13th and 14th, that on the 14th covering most of the State and being heavy enough to nip tender vegetation over considerable areas, and corn leaves on low ground. There was considerable damage to corn in the northeast corner of Poweshiek County, and in localities of Mahaska County.

In spite of the cool weather, corn has made fair progress toward maturity. Slightly more than half is now safe from frost, which is better than the average of the last 10 years on this date, and somewhat better than the expectations of monthly reporters on September 1. Estimates range from 25% safe in several southern counties, to as much as 90% or 95% in portions of Ida and Buena Vista counties. Late corn is still in roasting ear stage. Silo filling and fodder cutting is far advanced, and considerable hogging is under way.

Preparations are going forward for winter wheat seeding, but not much has been seeded. The ground is too hard for plowing in some counties.

Some third crop alfalfa was cut during the week but the yield is generally light. Some sweet clover also was cut. An unusually large number of reports have been received of increased acreage of clover cut for seed, and hulling returns show fair to good yields.

Potato digging and onion lifting are under way. Canneries are rushing the sweet corn and tomato pack.

Bulletin No. 25, September 24, 1929—

The first of the week was cold, cloudy and rainy, but the weather turned warm and sunny toward the close of the week. On the morning of the 18th a killing frost, with temperatures considerably below freezing, was general in three-fourths of the State, reaching southward to the northern part of the south-central district.

All tender vegetation and corn leaves in this area were killed, except in scattered highland areas. As usual, narrow areas extending up the Missouri River to Sioux City, and up the Mississippi to Dubuque, are escaping killing frost till later than other sections of the same latitude. In relatively small areas, mostly in Kossuth, Webster and Iowa counties, the freeze reached through the husks and froze the immature kernels, but for the most part the freeze did not reach the kernels, so with favorable weather the immature corn will be chaffy but not sour. About 73% of the corn is now safe, or has so far escaped frost, and some upland corn, mostly in the south two tiers of counties, will yet mature if the weather is favorable. The temperature for the last three weeks has averaged 5.5° below normal. A little silo filling and fodder cutting remains to be done. Some corn is being snapped for feeding.

Cattle are being brought into the State in larger numbers than last year to consume the corn. Hog cholera is becoming very serious in many counties. In some neighborhoods nearly all of the hogs have died. The situation is worse than for two or three years.

Sugar beet lifting is about to begin in the sugar beet area in north-central Iowa, and factories will start this week. Potato digging is progressing. Clover hulling has been resumed since the warm, sunny weather of the last few days. The yields are generally good.

Commercial sweet corn was mostly packed safely before the frost. While the leaves of tomato vines were killed, the frost was not sufficient to kill the stems or injure the fruit in many cases, so the canning of tomatoes continues later than it otherwise would. The dry weather of August delayed the fruiting of tomatoes. Grape leaves were generally killed but the heavy crop of fruit was not injured much. Large commercial apple orchards that were cared for in Polk County are ripening a good crop of fruit, though the general apple crop is not very good.

Bulletin No. 26, October 1, 1929—

The past week was warm in contrast with the cool weather of the preceding three weeks. Sunshine averaged about normal. Showers occurred in portions of the State each day except Wednesday and Monday, and were heavy in the northern portion of the State on Sunday.

Corn dried well in spite of the rains, and late corn in the extreme southern counties and on uplands elsewhere not killed by the frost of September 18, made good progress toward maturity. At least 80% of the corn is now safe for the State as a whole, and some may yet mature. Considerable will be chaffy and light, but not much soft and sour.

The rains have softened the soil so fall plowing has been active and winter wheat seeding has made progress. Sugar beets are arriving at the factories but the beets seem smaller than usual. Potato digging is in progress, with fair yields. Commercial sweet corn canning continues in the extreme southwest counties. Late vegetables are going to market in abundance.

Clover seed hulling is unusually active, and it is believed that earlier estimates of acreage and yield are too conservative. New seedings of clover, timothy and alfalfa are doing well. A little stack threshing of oats and winter wheat was done in Monona County the past week. The practice of stacking small grain is almost wholly confined to a few west-central counties. The harvest of soybeans for seed is nearing completion in the southern counties.

Hog cholera ravages seem to be slacking up a little.

CROP SEASON WEATHER, 1929, BY WEEKS

Average rainfall, mean temperature and mean sunshine, with departures from the normal, as derived from records of selected stations.

Week Ending	Rainfall (Inches)		Temperature (Deg. F.)		Sunshine	
	State Average	Departure	Mean	Departure	Per Cent	Departure
April 9	0.5	—0.1	61.1	+16.2	72	+15
April 16	0.9	+0.2	44.1	—3.8	47	—10
April 23	1.0	+0.3	49.2	—1.7	49	— 5
April 30	1.7	+0.9	53.0	—0.6	59	— 5
May 7	0.1	—0.8	47.3	—8.7	62	+ 2
May 14	1.3	+0.3	56.5	—2.2	52	— 9
May 21	0.2	—0.8	53.1	—7.8	66	+ 4
May 28	0.5	—0.7	65.5	+2.5	70	+ 7
June 4	1.2	+0.1	64.6	—0.7	49	—14
June 11	0.4	—0.7	65.5	—1.8	70	+ 6
June 18	0.9	—0.1	70.1	+1.0	62	— 4
June 25	0.3	—0.7	70.3	—0.1	76	+ 6
July 2	1.2	+0.3	71.2	—0.9	75	+ 5
July 9	1.2	+0.3	72.2	—0.9	61	—13
July 16	1.9	+1.0	72.8	—1.2	49	—25
July 23	0.1	—0.7	72.5	—1.5	73	— 1
July 30	0.5	—0.3	79.2	+5.2	80	+ 7
August 6	1.5	+0.7	70.8	—3.1	64	— 8
August 13	0.3	—0.5	74.6	+1.9	73	+ 1
August 20	0.1	—0.7	67.5	—4.1	83	+12
August 27	0.4	—0.4	75.9	+5.6	74	+ 6
September 3	0.2	—0.6	73.7	+5.1	83	+18
September 10	2.0	+1.1	63.2	—3.7	50	—12
September 17	0.3	—0.7	58.4	—6.5	67	+ 5
September 24	0.6	—0.2	56.6	—6.3	60	— 1
October 1	0.8	+0.1	64.4	+4.1	54	— 7
For the season	20.1	—1.7	64.4	—0.6	64	— 1

WEEKLY NOTES ON WEATHER AND CROPS IN IOWA

Week Ending October 8, 1929—

Temperatures of the week averaged somewhat below normal in northeast Iowa and somewhat above normal in the southwest portion of the State, with occasional light to moderate frosts that caused very little damage. The northern half of the State was nearly rainless but light to moderate showers occurred in the south-central and southeast counties, and moderately heavy rains in the southwest. Sunshine averaged slightly above normal.

Corn made satisfactory progress in drying, and considerable late corn in the southern counties got out of the way of frost. Husking has started on occasional farms in the northwest and west-central counties, but the corn is still too moist to crib in quantities. Considerable corn is being snapped for feed.

Winter wheat seeding continues though in some localities the soil is too dry to prepare a satisfactory seed bed. The earlier seeded winter wheat is up to a good stand except in some west-central counties where it is too dry for germination. This is particularly true in Monona County, which is the leading winter wheat county of the State. It is interesting to note that in Monona County a second crop of alfalfa seeded with winter wheat, has been cut since the wheat was harvested, which makes an excellent total return from the land.

Clover seed hulling continues with greater activity than for several years. This has already brought the price down decidedly, but at the same time it will provide the farms as a whole with a bountiful supply of seed at moderate cost, which has been sorely needed for several years in the soil building program.

Sugar beet harvest went forward with unusual rapidity the past week, and the factories immediately fell into a stride of about 1,000 tons of beets each worked up per day. Soybean harvest made good progress in the southern counties. Apple picking and potato digging are active. Potatoes are of good quality but light to moderate yield, and selling for about $1.00 per bushel in the field.

Week Ending October 15, 1929—

Cloudy, rainy weather prevailed till toward the close of week when it cleared, with light to heavy frosts in the central and northeast portions of the State, followed by sunny and warm at the close of the week.

Corn dried and matured slowly and a little more became safe from frost in the southern counties. Corn huskiug was brought to a halt but some snapping continued for feeding.

The rains helped fall plowing, winter wheat, pastures, meadows, alfalfa and new seedings. Many late truck crops have survived the frosts and are doing well, including a large portion of the tomato vines, which continue to mature fruit. Many tender flowers, such as dahlias, are blooming profusely as far north as Cedar Rapids. Potato digging is far advanced. The yields are only fair but the quality is good. Potato prices are high due largely to the short crop in the potato States to the norhward. Sugar beet lifting was delayed by the rains, yet the factories are making record daily runs.

Week Ending October 22, 1929—

The past week was dry, warm and sunny, with considerable wind till Saturday, when rain became general, except in the northwest portion of the State.

Corn made good progress in drying in the northern and central districts, and advanced toward maturity in the belated southern counties. Corn husking by hand and by machine was active in the northwest counties, some of which report 20% to 25% of the husking finished, though some corn in the cribs had to be shoveled over and otherwise saved from heating because of the high moisture content. A little husking has been done even in some extreme southern counties.

Tomato vines are still producing in many protected localities, and pumpkin vines are still alive in the extreme south. Tender flowers are still blooming in protected situations as far south as Oelwein.

Some winter wheat seeding is still being done. Clover hulling continues.

Week Ending October 29, 1929—

Snow ranging from four to five inches in some of the eastern counties to flurries in the air, melting as they fell, in the central counties, occurred at the beginning of the week, and general rain at the close. Temperatures averaged slightly below normal, with two rather general freezes. Sunshine was about normal.

Corn husking made excellent progress in the northwest one-fourth of the State, where in some counties 40% to 50% of the work is done, with a good many farms finished. Husking machines are numerous and conditions have been unusually favorable for their use. Husking has a good start in the northeast counties but only a beginning has been made in the southern third of the State.

Sugar beet harvest continued to make excellent progress under unusually good conditions. Winter wheat has made better growth than usual.

Week Ending November 5, 1929—

Most of the past week was cloudy and rainy, with snow in the northern counties, which stopped corn husking. On Friday the weather cleared and turned cooler so corn husking was resumed in the northern counties, but little could be done in the southern counties, for the fields were too wet and the corn too full of moisture to crib safely. The yields so far reported

are somewhat below last year. Ice formed on still, exposed water surfaces in the mornings toward the close of the week. While these freezes were good for corn husking they probably put an end to the germinating possibilities of much of the corn, which still contains considerable moisture.

Winter wheat, meadows and pastures are in good condition. Sugar beet harvest is being pushed vigorously and the factories are busy. Potato digging is nearly done, with fair yields, and a very good prices.

Farm animals are generally in good health though there are occasional small outbreaks of hog cholera. Many farm animals were wounded by hunters in northern Iowa during the recent open season for pheasants.

Week Ending November 12, 1929—

Dry weather prevailed till toward the close of the week. Temperatures averaged slightly below normal, with many frosty mornings. Sunshine was about normal.

These conditions were favorable for corn husking, which made good progress except in the extreme southern counties where the corn still contains too much moisture to husk easily or crib safely. In the northwest counties about three-fourths of the husking has been done and for the State as a whole, this work is about half finished. Disappointing yields are reported from portions of Story and Poweshiek counties, but in the northwest counties the corn is turning out better than expected. Husking machines are more numerous than ever and conditions are unusually favorable for their use. In some localities nearly all of the corn has been husked by machines.

Livestock is following the huskers, with favorable weather and fields not too wet. One does not have far to travel to see a beautiful picture of the Iowa gleaners. The health of livestock is good, though of course there are the usual reports of various deaths. At this date cholera appears to be less prevalent than usual. It is now about the time for serious outbreaks of hog flu, which is usually associated with the first cold wave and heavy snow.

Week Ending November 19, 1929—

Several inches of snow in the west and north portions of Iowa at the beginning of the week, and frequent rains in other portions, greatly delayed corn husking. The fields are now too soft to draw full loads of corn through them and the husks of the corn are damp and too tough for rapid hand husking. There is not much chance for the ground to dry out, so husking will go slow till the ground freezes. Temperatures of the past week averaged nearly a degree below normal, and sunshine 7 per cent below normal. For the State as a whole, about 60 per cent of the husking has been done. Some new corn has been shelled and marketed.

Winter wheat and pastures have made good growth and look green and luxuriant. The condition of livestock continues good. The number of cattle on feed is apparently not as large as the reports earlier in the fall indicated.

Week Ending November 26, 1929—

Dry and abnormally cold weather with about normal sunshine prevailed in Iowa during the past week. Temperatures of zero or lower on the 22d were general in the northern half of the State and in all portions the record low temperature for the time of year was nearly equaled.

The ground froze hard in the north and a few inches in the south. This aided corn husking by hand, except when the weather was too cold and windy to work. However, the husking machines did not work so well on the rough frozen ground.

Husking is nearing completion in the north but only about half done in the extreme southeast. Shelling and marketing is becoming active in the drier northwest counties where the price paid to farmers for No. 4 corn is about 68 cents per bushel. Most of the corn grades No. 4, though an occasional sample tested by the Iowa Weather and Crop Bureau would grade No. 2.

Hog flu was given a good start by the zero temperatures and strong winds of the week.

Week Ending December 3, 1929—

Following mild weather at the beginning of the week, severe winter weather set in over Iowa on Thanksgiving Day, November 28, with temperatures of zero or lower over most of the State on two or three days. Temperatures around 10 below zero occurred in the north-central portion of the State on November 29, and in much of the State the lowest November temperatures were recorded since 1898. About twice as much rain or snow as usual occurred during the week, and on this date the State is generally snow covered, the cover ranging from two to six inches.

Corn husking is practically finished in the northern half of the State, but about 40 per cent is still in the fields in some of the extreme southern counties.

Winter wheat and grasses were generally well protected by snow cover during the severe temperatures, though as usual there was considerable drifting. South to northwest gales on the 27th were the highest that have occurred in Iowa in the fall months since November 30, 1922.

MONTHLY PERCENTAGE CONDITIONS OF CROPS AND YIELD PER ACRE, 1929

Crops	April 1	May 1	June 1	July 1	Aug. 1	Sept. 1	Oct. 1	Yield Per Acre
Corn	----	----	83	83	86	81	83	40.0 bu.
Oats	----	----	87	82	83	83	----	37.0 bu.
Winter wheat	89	90	87	87	----	----	----	19.7 bu.
Spring wheat	----	----	88	85	83	81	----	16.5 bu.
Barley	----	----	87	86	85	83	----	30.5 bu.
Rye	92	92	91	88	----	----	----	16.0 bu.
Flax seed	----	----	----	86	88	83	82	11.3 bu.
Potatoes	----	----	85	85	84	77	76	102.0 bu.
Tame hay	----	94	92	96	97	94	----	1.93 tons
Wild hay	----	----	89	89	90	----	----	1.35 tons
Alfalfa hay	----	----	93	97	96	90	----	3.10 tons
Pastures	91	93	91	90	93	78	83	----

FINAL CROP SUMMARY, DECEMBER 1, 1929

A value of $579,841,000 is placed on the estimated production of crops harvested in Iowa in 1929. This is an increase of 2.6% over the value of the crops in 1928 and places the 1929 crops at the highest value since 1919. Average prices on December 1, upon which these valuation figures are based, showed increases in corn, oats, wheat, flax seed, timothy seed, potatoes, pop corn and buckwheat; all others show decreases.

Corn: The total production of corn in Iowa is estimated at 437,760,000 bushels which is about 27,000,000 bushels less than the revised estimates of the 1928 crop. The average yield per acre is estimated at 40.0 bushels. With Iowa far above all other States in total production of corn, it seems probable that the estimated December 1 farm price of 70 cents is too low and may be expected to advance as soon as the usual winter glutting of the market has passed.

Oats: The total production of oats is estimated at 219,928,000 bushels, which is about 11,000,000 bushels less than was harvested in 1928. How-

ever, with an increase in the price per bushel to 39 cents the total value is about the same in both years.

Wheat: The total production of winter wheat is estimated at 8,499,000 bushels compared with 8,014,000 bushels in 1928. Spring wheat, 815,000 bushels compared with 716,000 bushels in 1928. The acreage of winter wheat this year was 407,000 acres, and spring wheat 47,000 acres. Average yields were about the same, but the price per bushel on December 1 was about 5 cents higher.

Barley: The acreage of barley decreased considerably from the largest acreage of this crop ever harvested in Iowa, in 1928. The total production this year is estimated at 19,581,000 bushels compared with 26,466,000 bushels last year. The price per bushel is 2 cents lower.

Tame Hay: The year 1929 will go down in history as one of the best hay years in the history of Iowa, due to a moist and humid spring and early summer. Clovers of all varieties grew exceptionally luxuriant. The acreage this year is estimated at 3,286,000 acres, about 400,000 acres more than in 1928, and the total production in 1929 was 6,342,000 tons compared with 4,276,000 tons in 1928. The December 1 price, however, decreased from $13.00 per ton to $11.00 per ton in 1929.

The yield and production of the different varieties of tame hay are as follows: mixed clover and timothy, 1,530,000 acres, 2,678,000 tons; clover alone, 650,000 acres, 1,332,000 tons; timothy alone 484,000 acres, 678,000 tons; alfalfa 410,000 acres, 1,271,00 tons; sweet clover hay 50,000 acres, 118,000 tons; grains cut green 30,000 acres, 51,000 tons; annual legumes 42,000 acres, 97,000 tons and all other tame hay 90,000 acres, 117,000 tons.

Potatoes: The potato crop is estimated at 7,650,00 bushels compared with 10,395,000 bushels in 1928. The December 1 farm price was placed at $1.40 per bushel compared with 51 cents in 1928, making the smaller crop of 1929 worth about twice as much as the crop of 1928. However, the smaller crop in Iowa is not the only factor in this situation; practically all of the large producing States in the U. S. show large decreases which makes the total crop considerably shorter than in 1928.

Minor Crops: Clover seed, 154,000 bushels; timothy seed, 500,000 bushels; flax seed, 124,000 bushels; buckwheat, 81,000 busels; sorghum sirup, 390,000 gallons; sweet potatoes, 315,000 bushels; apples, 2,120,000 bushels; peaches, 55,000 bushels; pears, 52,000 bushels; grapes, 6,675 tons; cabbage, 6,400 tons; cucumbers for pickles, 62,000 bushels; sweet corn for canning, 108,000 tons; onions, 844,000 bushels; watermelons, 291 car loads (cars of 1,000 melons each); cantaloupes, 39,000 crates; asparagus, 94,000 crates; strawberries, 4,170,000 quarts; tomatoes, 31,000 bushels.

IOWA CROPS 1928 AND 1929 COMPARED

Acreage, Average and Total Yield, Average and Total Value

Crop	1928 Final Revision					December 1, 1929, Estimates*					
	Acres	Average Yield	Total Yield	Average Price Dec. 1	Total Value	Acres	Average Yield	Total Yield	Average Price Dec. 1	Gross Value Per Acre	Total Value
Corn	11,202,000	41.5 bu.	464,883,000	$ 0.67	$311,472,000	10,944,000	40.0 bu.	437,760,000	$ 0.70	$ 28.00	$306,432,000
Oats	6,004,000	38.5 "	231,154,000	0.37	85,527,000	5,944,000	37.0 "	219,928,000	0.39	14.43	85,772,000
Winter wheat	411,000	19.5 "	8,014,000	1.00	8,014,000	407,000	19.7 "	8,018,000	1.06	20.88	8,499,000
Spring wheat	41,000	17.3 "	709,000	1.01	716,000	47,000	16.5 "	776,000	1.05	17.32	815,000
Barley	802,000	33.0 "	26,466,000	0.54	14,292,000	642,000	30.5 "	19,581,000	0.52	15.86	10,182,000
Rye	49,000	15.5 "	760,000	0.86	654,000	50,000	16.0 "	800,000	0.85	13.60	680,000
Flax seed	19,000	10.4 "	198,000	1.98	392,000	11,000	11.3 "	124,000	2.75	31.08	341,000
Timothy seed	104,000	3.63 "	377,000	2.15	811,000	125,000	4.00 "	500,000	2.20	8.80	1,100,000
Clover seed (red and alsike)	38,000	1.30 "	49,000	18.00	882,000	114,000	1.35 "	154,000	11.00	14.85	1,694,000
Soy beans (for beans only)	20,000	12.0 "	260,000	1.78	641,000	44,000	12.0 "	528,000	1.67	20.04	882,000
Potatoes	81,000	135.0 "	10,395,000	0.51	5,577,000	75,000	102.0 "	7,650,000	1.40	142.80	10,710,000
Hay (tame)	2,880,000	1.48 tons	4,276,000	13.00	55,588,000	3,286,000	1.93 tons	6,342,000	11.00	21.23	69,762,000
Hay (wild)	264,000	1.16 "	306,000	10.00	3,060,000	280,000	1.35 "	378,000	8.70	11.74	3,289,000
Pasture and grazing	10,055,000			5.80	59,626,000	10,089,000			6.07	6.07	61,240,000
Sweet corn (com'l crop)	40,000	2.3 "	92,000	9.75	897,000	47,000	2.3 "	108,000	9.50	21.85	1,026,000
Pop corn	21,000	1,700 lbs.	35,355,000	0.02½	884,000	28,000	1,740 lbs.	48,720,000	0.02¾	47.85	1,340,000
Buckwheat	6,000	14.5 bu.	87,000	0.90	78,000	6,000	13.5 bu.	81,000	0.95	12.82	77,000
Fruit crop					5,500,000						5,500,000
Garden truck					5,500,000						5,500,000
Miscellaneous					5,000,000						6,000,000
Total value, not including live stock products, for the year 1929											579,841,000
1928											565,111,000
1927											523,167,000

*Subject to revision when assessors' figures become available.

AVERAGE FARM PRICE OF IOWA'S PRINCIPAL CROPS AND PER CENT OF CORN HUSKING DONE DECEMBER 1, 1929, BY COUNTIES

Districts and Counties	Corn		Oats per bushel of 32 lbs.	Winter wheat per bushel of 60 lbs.	Spring wheat per bushel of 60 lbs.	Barley per bushel of 56 lbs.	Rye per bushel of 56 lbs.	Flax seed per bushel of 56 lbs.	Buckwheat per bushel of 48 lbs.	Timothy seed per bushel of 45 lbs.	Clover seed per bushel of 60 lbs.	Pop corn per pound in ear	Soy beans per bushel of 60 lbs.	*Tame hay (loose) per ton of 2,000 lbs.	Wild hay (loose) per ton of 2,000 lbs.	White potatoes(Irish) per bushel of 60 lbs.	Sweet potatoes per bushel of 50 lbs.	Apples per bushel of 48 lbs.	Sorghum sirup, per gallon	Honey (Per lb.)		
	Per cent husking done, December 1	Per bu. of 70 lbs. in ear or 56 lbs. shelled																		Comb in sections	Extracted (less cost container)	In bulk
Northwest—																						
Buena Vista	97	$ .69	$ .37	$ 1.12	$ 1.00	$ .50					$17.82	$ .03		$13.71	$14.10	$ 1.49		$ 2.06	$ .95	$ .15	$ .12	$ .14
Cherokee	93	.68	.37			.48				$ 1.98	11.82	.04		12.09	9.52	1.05		2.36		.16	.14	.12
Clay	91	.67	.35			.46	$ .84	$ 2.80		2.40	14.07	.02		13.82	9.85	1.35	$ 2.51	2.11		.14		
Dickinson	90	.64	.36	.90	.88	.48	.85	3.00			19.82	.02		10.78	8.27	1.30		2.11		.14	.10	.10
Emmet	90	.65	.36	1.00		.46	.97							17.71	14.85	1.26		1.36	1.25	.12		.10
Lyon	97	.67	.36			.48		3.00	$ .62		14.82			10.05	7.21	1.19		2.19		.13		
O'Brien	96	.68	.37			.54	.74	2.80				.06	$ 1.52	13.09	9.18	1.09		2.17	1.13	.18	.14	.09
Osceola	91	.64	.36			.50		3.03		2.92	19.82	.02	1.50	14.38	9.85	1.06			1.20	.16		
Palo Alto	92	.69	.38			.47	.82	2.35		2.98	11.82	.04	2.00	13.88	9.85	1.36		1.86	1.20	.14	.15	.11
Plymouth	94	.71	.38	1.00	1.00	.47	.49				11.32			13.71	11.25	1.15		1.86		.20	.11	.08
Pocahontas	93	.68	.36	1.10	1.18	.45		3.10		3.98	12.32	.06	2.00	12.78	9.85	1.22		1.11	.95	.13	.20	
Sioux	96	.68	.36	.95	.95	.51				4.48	17.82	.03		13.38	10.25	1.35		2.04		.20	.08	.07
For District	94	$ .68	$ .37	$ 1.03	$ 1.03	$ .48	$ .81	$ 2.83	$ .62	$ 2.95	$14.98	$ .04	$ 2.01	$13.19	$ 9.92	$ 1.24	$ 2.51	$ 1.98	$ 1.09	$ .15	$ .12	$ .10
North Central—																						
Butler	97	$ .69	$ .38			$ .49							$ 1.75	$10.38	$ 7.60	$ 1.51		$ 1.51		$ .16		
Cerro Gordo	94	.67	.37			.46	$ .84	$ 2.80		$ 2.48	$16.82			13.21	8.85	1.33		1.11		.17	$ .10	$ .09
Floyd	96	.67	.37			.54	.92	2.60		2.43	13.32	$ .06	1.88	11.38	7.85	1.50		1.61		.16	.10	
Franklin	92	.69	.38	$ .95	$ .96	.48	.79	3.25	$ 1.22	2.98	18.32	.06	2.50	11.24	8.25	1.23	$ 2.01	1.65	$ 1.20	.19	.12	.12
Hancock	95	.67	.37		.90	.49				2.98	11.32	.08		11.52	8.03	1.23	1.96	1.80		.12	.15	.15
Humboldt	96	.68	.36			.54						.07		12.38	8.60	1.41		2.36		.11	.09	.08
Kossuth	97	.67	.37			.49					14.82			14.02	8.23	1.23		1.77		.14	.12	.10
Mitchell	93	.71	.35	1.25	1.12	.48	.79	2.75	.97	2.57	11.82		2.50	7.76	5.47	1.29		1.49		.22	.15	
Winnebago	94	.63	.36	1.05	1.10	.46	.78	2.75			19.82	.08		13.42	9.02	1.17		2.48	1.45	.15	.10	.08
Worth	98	.62	.35		.95	.44	.76	3.00	.82	2.48	11.82			9.38	6.85	1.21		.98	1.39	.19	.12	.10
Wright	92	.69	.37			.49	.87			2.98	17.82			13.18	10.85	1.46		1.69	1.13	.14	.14	
For District	95	$ .67	$ .37	$ 1.08	$ 1.01	$ .49	$ .80	$ 2.83	$ 1.00	$ 2.73	$14.83	$ .07	$ 2.10	$11.87	$ 8.14	$ 1.29	$ 1.98	$ 1.67	$ 1.22	$ .16	$ .12	$ .10
Northeast—																						
Allamakee	98	$ .76	$ .45	$ 1.07	$ 1.03	$ .59	$ .88		$ .82	$ 4.86	$12.78		$ 2.56	$ 9.32	$ 7.85	$ 1.56		$ 2.36	$ 1.32	$ .18	$ .14	$ .15
Black Hawk	94	.69	.39	.99		.52	.82			2.04	15.83	$ .06	1.58	11.38	7.85	1.45		1.38	1.20	.21	.12	
Bremer	96	.76	.42			.62				2.48	14.82	.06	2.00	11.88	9.10	1.54		1.38	1.15	.20	.12	.15
Buchanan	92	.70	.42			.53	.79			2.19	13.11	.06	1.62	7.38	4.92	1.46		1.86	1.42	.17	.12	.10
Chickasaw	95	.71	.40		1.00	.57			.97	1.85	16.32			9.80	6.85	1.43		1.36		.20		
Clayton	99	.85	.47			.67				2.37	13.82	.08		9.18	6.85	1.51		1.82	1.30	.15	.10	.10
Delaware	91	.74	.40	1.25	1.20	.59	.87		1.17	2.27	13.07	.06	2.00	9.60	6.71	1.48		1.72	1.21	.18	.13	.10
Dubuque	99	.79	.42	1.00	1.00	.60	.69			2.86	10.82	.06	2.00	9.38		1.49		1.38		.12	.10	.10
Fayette	94	.72	.44	1.25	1.25	.58	.99	$ 2.20	.97	2.06	14.07	.06	2.44	10.06	6.47	1.41		1.57	1.45	.18	.17	
Howard	95	.69	.38	1.00	1.00	.49	.69	2.40	.77	2.98	19.82	.12		13.38	6.73	1.31		1.76		.18	.15	.12
Winneshiek	98	.74	.45	1.21	1.19	.61	.79	2.30	.97	2.21	20.49	.09		9.67	7.65	1.53		1.31	1.29	.17	.11	.11
For District	95	$ .74	$ .43	$ 1.12	$ 1.12	$ .58	$ .82	$ 2.33	$ .93	$ 2.28	$14.06	$ .07	$ 2.02	$ 9.82	$ 6.81	$ 1.48		$ 1.63	$ 1.29	$ .18	$ .13	$ .12
West Central—																						
Audubon	96	$ .72	$ .36	$ 1.00	$ .98	$ .46	$ .76			$ 2.31	$11.82	$ .06		$11.98	$11.85	$ 1.33		$ 2.76	$ 1.07	$ .16	$ .13	$ .10
Calhoun	94	.70	.37	1.10		.49	.94			1.98	14.82	.06		14.67	9.85	1.35		1.82	1.12	.15	.14	.10
Carroll	96	.69	.37	1.11	1.08	.50	.84			2.48	12.49	.02	$ 2.75	9.88		1.09		1.85		.18	.10	
Crawford	86	.71	.39	1.04	1.04	.55	.94			2.98	9.82	.04		13.52	11.85	1.15		2.34	1.13	.18	.16	.15
Greene	92	.68	.36			.47	.86			3.91	11.63	.05	2.25	14.88	9.95	1.59	$ 1.76	2.07	.96	.16	.13	.12
Guthrie	86	.68	.36	1.01	.95	.50	.81			1.86	10.02	.06		11.13	9.85	1.60		2.05	1.19	.19	.17	.12
Harrison	76	.66	.39	1.00	.95	.62	.89					.05		11.52	12.18	1.22	1.38	2.07	1.09	.15	.17	.10
Ida	92	.72	.36			.50				3.98	11.32	.02		9.88	9.85	1.31		1.86		.15		
Monona	79	.69	.38	1.04	1.03	.47	.84	$ 3.00				.07		9.38	8.18	1.10		2.11	.95	.15	.10	
Sac	95	.70	.37			.48				2.48	16.15	.02	2.25	13.18	9.85	1.23		2.16	1.20	.16	.18	.10
Shelby	86	.69	.40	1.10	1.02	.63				1.98	10.46	.08	2.50	15.62	10.60	1.33	2.51	1.86	1.07	.15	.11	.10
Woodbury	86	.69	.38	1.03	1.04	.51	.87			2.36	11.42	.02	2.00	10.60	10.02	1.16		1.86		.11	.10	.09
For District	89	$ .69	$ .38	$ 1.04	$ 1.02	$ .51	$ .86	$ 3.00		$ 2.58	$11.58	$ .04	$ 2.08	$12.56	$10.31	$ 1.31	$ 1.76	$ 2.07	$ 1.08	$ .16	$ .14	$ .11
Central—																						
Boone	92	$ .68	$ .37	$ 1.05	$ 1.08	$ .48				$ 2.40	$12.20	$ .06	$ 1.20	$14.13	$11.68	$ 1.51	$ 1.61	$ 1.71	$ 1.11	$ .15	$ .12	$ .11
Dallas	92	.72	.38	1.01						2.60	10.49		3.00	22.18	9.85	1.59	1.76	1.61	1.07	.16	.13	.08
Grundy	93	.71	.39	1.09	1.09	.50	$ .59			2.18	13.82			10.05	9.35	1.26		1.11	1.07	.16	.13	.12
Hamilton	95	.67	.37	1.05	1.03	.44	.69		$ .97	2.98	9.82	.08		15.38	12.10	1.32	2.78	1.91	1.10	.15	.12	.08
Hardin	96	.70	.38			.47								11.76	5.85	1.52		2.09	1.45	.17	.10	
Jasper	92	.71	.38	1.09	1.06	.60	.94			2.44	11.11	.06	1.50	10.52	8.18	1.61	1.26	1.81	1.01	.15	.11	.12
Marshall	93	.70	.37	1.23	1.25	.55				2.59	13.51	.08	2.00	11.52		1.40	2.01	2.19	1.10	.17	.11	.10
Polk	85	.70	.38	1.09	1.13	.45	1.04			2.43	11.27	.05	1.47	12.60	9.35	1.66	1.97	1.75	1.31	.18	.15	.13
Poweshiek	90	.69	.37			.50				1.58	11.82			11.38		1.76		2.86		.25		
Story	90	.68	.37	1.04	1.07	.50	.84				10.32	.02		12.52	6.85	1.26		1.44	1.45	.20	.18	
Tama	95	.71	.37	1.05	1.02	.53	.82			2.84	13.22	.06	1.41	11.88	6.35	1.43		1.81	1.20	.20	.19	.17
Webster	93	.69	.37	1.18	1.25	.49	.69			2.48	14.82	.11	2.00	11.38	8.85	1.36		1.96	1.26	.17	.15	
For District	92	.69	.37	1.08	1.09	.50	.82		.97	2.50	12.17	$ .07	$ 1.51	$12.50	$ 9.56	$ 1.47	$ 1.99	$ 1.83	$ 1.16	$ .17	$ .13	$ .12

AVERAGE FARM PRICE OF IOWA'S PRINCIPAL CROPS AND PER CENT OF CORN HUSKING DONE DECEMBER 1, 1929, BY COUNTIES—Continued

Districts and Counties	Corn		Oats per bushel of 32 lbs.	Winter wheat per bushel of 60 lbs.	Spring wheat per bushel of 60 lbs.	Barley per bushel of 56 lbs.	Rye per bushel of 56 lbs.	Flax seed per bushel of 56 lbs.	Buckwheat per bushel of 48 lbs.	Timothy seed per bushel of 45 lbs.	Clover seed per bushel of 60 lbs.	Pop corn per pound in ear	Soy beans per bushel of 60 lbs.	*Tame hay (loose) per ton of 2,000 lbs.	Wild hay (loose) per ton of 2,000 lbs.	White potatoes(Irish) per bushel of 60 lbs.	Sweet potatoes per bushel of 50 lbs.	Apples per bushel of 48 lbs.	Sorghum sirup, per gallon	Honey (Per lb.)		
	Per cent husking done, December 1	Per bu. of 70 lbs. in ear or 56 lbs. shelled																		Comb in sections	Extracted (less cost container)	In bulk
East Central—																						
Benton	92	$ .69	$ .38	$ 1.17	$ 1.12	$ .59	$ .84	.....	.....	$ 2.03	$12.15	$ .06	$ 1.74	$ 8.88	$ 7.10	$ 1.61	$ 2.76	$ 1.87	$ 1.20	$ .16	$ .10	$ .10
Cedar	92	.75	.40	1.27	1.20	.58	.....	.....	.....	1.65	12.92	.....	.....	8.63	.....	1.69	.....	2.04	1.05	.....	.....	.....
Clinton	88	.75	.41	1.13	1.11	.53	.96	.....	.....	1.98	12.32	.06	.....	10.05	7.42	1.48	.....	1.55	.....	.15	.12	.....
Iowa	94	.71	.40	1.00	1.01	.56	.91	.....	.....	2.55	8.68	.06	.....	8.00	.....	1.41	1.01	1.11	1.28	.15	.14	.12
Jackson	95	.76	.46	1.22	1.25	.62	.94	.....	.....	2.10	12.11	.06	4.00	10.38	8.35	1.64	.....	1.88	1.14	.15	.10	.12
Johnson	90	.79	.41	.95	.96	.55	.....	.....	.....	2.17	11.62	.06	1.75	11.13	.....	1.37	1.26	1.51	1.15	.18	.13	.10
Jones	91	.73	.42	.....	1.10	.50	.....	.....	.....	2.48	12.82	.....	.....	8.05	.....	1.58	.....	1.61	1.07	.12	.10	.....
Linn	89	.69	.40	1.18	1.23	.60	.79	.....	.....	2.33	12.82	.05	1.50	10.82	9.35	1.59	1.34	1.93	1.19	.19	.14	.10
Muscatine	88	.73	.40	1.10	.....	.55	.84	.....	.....	2.40	12.82	.....	1.41	9.88	7.85	1.53	.....	1.44	1.20	.15	.....	.15
Scott	94	.79	.41	1.06	1.08	.59	.92	.....	.....	2.09	13.72	.....	2.00	14.62	10.52	1.62	.....	1.73	.85	.16	.13	.11
For District	92	$ .74	$ .41	$ 1.12	$ 1.14	$ .58	$ .87	.....	.....	$ 2.13	$12.11	$ .06	$ 1.84	$10.12	$ 8.38	$ 1.54	$ 1.54	$ 1.70	$ 1.15	$ .16	$ .12	$ .11
Southwest—																						
Adair	86	$ .69	$ .38	$ 1.01	$ 1.00	$ .51	$ .87	.....	.....	$ 2.05	$ 9.72	$ .08	$ 1.75	$ 8.63	$ 4.85	$ 1.71	$ 2.26	$ 1.96	$ 1.30	$ .16	$ .12	$ .10
Adams	74	.78	.47	1.05	.90	.55	.64	.....	.....	2.98	9.99	.06	.....	12.88	9.10	1.41	1.76	2.11	1.20	.13	.10	.08
Cass	88	.68	.38	1.03	1.04	.46	.81	.....	.....	2.38	9.82	.08	1.50	12.68	9.85	1.62	1.76	1.94	1.98	.14	.12	.09
Fremont	69	.69	.41	1.02	.....	.....	.99	.....	.....	2.48	9.15	.04	.....	10.63	7.85	1.29	1.26	1.91	1.13	.15	.15	.15
Mills	68	.73	.39	1.04	.....	.52	.....	.....	.....	.....	9.32	.05	.....	10.21	9.85	1.37	1.76	1.55	.....	.20	.....	.....
Montgomery	70	.70	.38	1.01	1.02	.66	.94	.....	.....	1.90	10.32	.05	2.50	10.13	11.60	1.40	2.26	2.00	1.18	.15	.14	.12
Page	65	.74	.41	1.07	1.00	.52	.96	.....	.....	2.33	9.32	.04	3.00	11.26	5.35	1.43	1.58	1.98	1.03	.15	.16	.12
Pottawattamie	72	.70	.38	1.07	1.08	.50	.97	.....	.....	1.98	9.91	.05	.....	13.13	9.85	1.30	2.76	1.89	1.14	.16	.12	.10
Taylor	68	.77	.44	1.00	.90	.62	.94	.....	.....	1.73	9.82	.04	2.33	10.48	6.85	1.71	2.01	1.59	1.20	.17	.18	.18
For District	72	$ .71	$ .40	$ 1.04	$ 1.01	$ .53	$ .91	.....	.....	$ 2.11	$ 9.66	$ .05	$ 2.22	$11.18	$ 8.34	$ 1.46	$ 1.75	$ 1.88	$ 1.18	$ .15	$ .13	$ .12

South Central—																						
Appanoose	76	$ .78	$ .43	$ 1.14	$ 1.00	$ .60	$ 1.02	.....	$ .87	$ 2.32	$10.21	$ .04	$ 1.35	$ 9.13	$ 9.85	$ 1.73	$ 2.14	$ 1.81	$ 1.07	$ .18	$ .12	$ .13
Clarke	78	.72	.39	1.09	.....	.48	.84	.....	.....	1.84	10.32	.08	1.25	8.38	.....	1.88	2.61	1.57	1.12	.19	.15	.10
Decatur	68	.73	.41	1.08	1.06	.....	.....	.....	.....	1.92	9.32	.....	1.67	10.13	.....	1.80	.....	2.01	1.28	.17	.15	.....
Lucas	73	.70	.39	1.15	.....	.61	.....	.....	.....	2.07	9.20	.05	1.85	9.77	8.85	1.58	.....	1.88	1.16	.18	.12	.11
Madison	88	.69	.38	1.05	1.10	.56	.84	.....	.....	1.85	10.54	.06	2.00	10.49	8.18	1.63	1.76	1.79	1.19	.17	.12	.08
Marion	86	.69	.37	.99	.97	.50	.99	.....	.....	2.48	9.82	.06	1.50	11.63	.....	1.59	2.16	2.07	1.11	.18	.10	.10
Monroe	72	.71	.39	1.07	1.08	.60	.....	.....	.....	2.00	11.02	.08	1.79	12.38	7.85	1.61	1.26	2.05	1.16	.22	.13	.10
Ringgold	74	.76	.41	1.02	1.00	.68	.87	.....	.....	1.69	9.15	.06	1.42	13.13	5.85	1.47	1.88	1.31	1.05	.22	.13	.19
Union	80	.72	.41	1.06	1.02	.67	.94	.....	.89	1.78	9.67	.06	1.25	9.71	7.85	1.76	2.76	1.68	1.23	.17	.15	.15
Warren	83	.67	.40	1.04	1.00	.58	.80	.....	.....	2.59	10.03	.12	1.60	11.45	6.85	1.55	1.42	1.61	1.16	.18	.14	.15
Wayne	67	.72	.39	1.08	.....	.50	.....	.....	.....	2.10	9.82	.....	1.45	8.13	.....	1.51	.....	1.74	1.00	.20	.12	.12
For District	78	$ .72	$ .40	$ 1.07	$ 1.02	$ .58	$ .94	.....	$ .88	$ 2.10	$ 9.96	$ .07	$ 1.55	$10.30	$ 8.31	$ 1.64	$ 1.93	$ 1.79	$ 1.13	$ .18	$ .12	$ .12
Southeast—																						
Davis	81	$ .78	$ .46	$ 1.06	.....	$ .50	$ 1.02	.....	.....	$ 2.21	$10.18	.....	$ 1.47	$ 8.05	.....	$ 1.68	$ 2.10	$ 1.92	$ 1.02	$ .16	$ .12	$ .10
Des Moines	72	.67	.39	1.03	1.00	.60	.81	.....	.....	2.04	11.32	$ .07	1.55	11.05	.....	1.20	1.36	1.77	1.20	.20	.17	.18
Henry	86	.69	.39	1.05	.....	.....	.79	.....	.....	1.56	10.07	.....	1.45	12.21	.....	1.63	.96	1.82	1.20	.17	.12	.16
Jefferson	80	.73	.41	1.07	1.05	.55	.81	.....	.....	2.14	10.52	.....	1.40	8.63	.....	1.59	1.64	1.48	1.04	.18	.12	.12
Keokuk	91	.73	.37	1.08	.....	.50	.....	.....	.....	2.56	11.12	.05	1.40	9.28	.....	1.47	.....	1.41	1.15	.16	.15	.....
Lee	75	.74	.43	1.07	.....	.....	.90	.....	$ .67	1.79	10.51	.06	1.65	13.46	.....	1.57	1.66	2.07	1.17	.21	.10	.16
Louisa	75	.74	.39	1.06	.....	.55	.85	.....	.....	2.64	10.32	.06	.....	8.88	.....	1.49	.76	1.80	1.20	.18	.11	.15
Mahaska	85	.71	.38	1.10	1.08	.58	.92	.....	.....	2.34	12.32	.05	1.51	9.75	$ 5.85	1.55	1.04	1.78	1.05	.18	.17	.10
Van Buren	76	.77	.40	1.10	.....	.55	.89	.....	.....	2.00	9.88	.06	1.81	8.58	.....	1.68	1.43	1.75	1.11	.17	.14	.11
Wapello	64	.73	.40	1.02	.95	.60	.84	.....	.97	1.79	10.22	.04	1.42	12.55	9.85	1.60	1.61	1.68	1.09	.17	.15	.15
Washington	86	.73	.40	1.08	1.15	.64	.....	.....	.....	2.44	10.37	.04	1.43	8.66	.....	1.53	.88	1.40	1.16	.19	.10	.09
For District	80	$ .73	$ .40	$ 1.06	$ 1.06	$ .59	$ .89	.....	$ .82	$ 2.16	$10.72	$ .05	$ 1.52	$10.05	$ 7.85	$ 1.59	$ 1.37	$ 1.70	$ 1.11	$ .18	$ .14	$ .14
For State	88	$ .70	$ .39	$ 1.06	$ 1.05	$ .52	$ .85	$ 2.75	$ .95	$ 2.26	$11.00	$ .02¾	$ 1.67	$11.00	$ 8.70	$ 1.40	$ 1.70	$ 1.80	$ 1.15	$ .17	$ .13	$ .12

*Tame hay includes alfalfa.

UNITED STATES CROP REPORT: DECEMBER, 1929

Crop and Year	Acreage	Production: Per Acre	Production: Total	Production: Unit	Farm Price on Dec. 1 Per Unit	Total Farm Value Based on Dec. 1 Farm Price
					Dollars	Dollars
Corn 1928	100,673,000	28.0	2,818,901,000	Bushels	.752	2,119,946,000
1929	98,018,000	26.8	2,622,189,000	"	.781	2,048,134,000
Winter wheat 1928	36,213,000	16.0	578,673,000	"	1.035	599,207,000
1929	40,162,000	14.4	578,336,000	"	1.065	616,128,000
Durum wheat (4 states) 1928	6,836,000	14.2	97,291,000	"	.719	69,966,000
1929	5,315,000	9.9	52,380,000	"	.882	46,217,000
Other spring wheat, U. S. 1928	15,223,000	15.7	238,912,000	"	.913	218,011,000
1929	15,664,000	11.2	175,792,000	"	1.016	178,576,000
All wheat 1928	58,272,000	15.7	914,876,000	"	.970	887,184,000
1929	61,141,000	13.2	806,508,000	"	1.043	840,921,000
Oats 1928	41,734,000	34.5	1,439,407,000	"	.409	589,048,000
1929	40,217,000	30.8	1,238,654,000	"	.435	538,845,000
Barley 1928	12,598,000	28.4	357,487,000	"	.552	197,459,000
1929	13,212,000	23.2	307,105,000	"	.550	168,907,000
Rye 1928	3,480,000	12.5	43,366,000	"	.860	37,290,000
1929	3,225,000	12.6	40,629,000	"	.871	35,371,000
Buckwheat 1928	749,000	17.6	13,148,000	"	.875	11,511,000
1929	729,000	15.8	11,505,000	"	.977	11,241,000
Flaxseed 1928	2,675,000	7.4	19,928,000	"	2.012	40,098,000
1929	2,990,000	5.6	16,838,000	"	2.843	47,871,000
Cotton 1928	45,341,000	[a]152.9	14,478,000	Bales	[b].180	1,301,796,000
1929	45,981,000	[a]155.3	14,919,000	"	[b].164	1,225,822,000
Cottonseed 1928	----------	----------	6,435,000	Tons	36.28	233,447,000
1929	----------	----------	6,630,000	"	30.33	201,096,000
Hay, tame 1928	58,140,000	1.61	93,351,000	"	12.27	1,145,660,000
1929	60,996,000	1.67	101,715,000	"	12.23	1,214,256,000
Hay, wild 1928	13,138,000	.98	12,915,000	"	7.35	94,896,000
1929	14,125,000	.91	12,924,000	"	8.11	104,797,000
All hay 1928	71,278,000	1.49	106,266,000	"	11.67	1,239,956,000
1929	75,121,000	1.53	114,639,000	"	11.77	1,349,053,000
Clover seed (red and alsike) 1928	617,000	1.56	961,000	Bushels	16.22	15,590,000
1929	1,369,000	1.58	2,157,000	"	10.16	21,922,000
Sweet clover seed 1928	227,000	4.01	909,400	"	3.75	3,409,000
1929	231,000	4.16	961,800	"	3.74	3,596,000
Alfalfa seed 1928	198,900	2.68	532,400	"	12.24	6,516,000
1929	258,400	2.78	717,800	"	10.69	7,672,000
Timothy seed 1928	332,000	3.70	1,229,400	"	2.20	2,705,000
1929	366,000	3.84	1,407,200	"	2.23	3,140,000
Soy beans[c] 1928	1,144,000	14.2	16,256,000	"	1.80	29,180,000
1929	1,375,000	13.2	18,146,000	"	1.87	33,979,000
Potatoes 1928	3,837,000	121.3	465,350,000	"	[d].539	251,048,000
1929	3,370,000	106.1	357,451,000	"	[d]1.314	469,701,000
Sweet potatoes 1928	810,000	95.9	77,661,000	"	.915	71,096,000
1929	822,000	103.0	84,661,000	"	.945	80,015,000
Tobacco 1928	1,894,100	726	1,374,547,000	Pounds	[d].202	278,386,000
1929	2,016,400	744	1,500,891,000	"	[d].190	285,583,000
Sugar beets 1928	644,000	11.0	7,101,000	Tons	[e]7.11	50,477,000
1929	717,000	10.7	7,672,000	"	[e]7.52	57,679,000
Sugar cane except for sirup (La.) 1928	131,000	16.0	2,099,000	"	[d]3.97	8,332,000
1929	190,000	16.0	3,040,000	"	[d]3.79	11,525,000
Cane sirup 1928	113,000	180.5	20,401,000	Gallons	.776	15,835,000
1929	124,000	189.2	23,458,000	"	.754	17,691,000
Sorgo sirup 1928	349,000	77.8	27,152,000	"	.917	24,890,000
1929	346,000	75.7	26,181,000	"	.922	24,136,000
Apples, total 1928	----------	----------	186,893,000	Bushels	.994	185,842,000
1929	----------	----------	139,754,000	"	1.317	184,107,000
Apples, Com'l 1928	----------	----------	35,461,000	Barrels	2.80	99,361,000
1929	----------	----------	28,973,000	"	3.74	108,281,000
Peaches, total 1928	----------	----------	68,369,000	Bushels	[d].987	63,643,000
1929	----------	----------	45,998,000	"	[d]1.363	62,705,000
Pears, total 1928	----------	----------	24,212,000	"	[d]1.019	24,663,000
1929	----------	----------	20,903,000	"	[d]1.433	29,952,000
Grapes, total[e] 1928	----------	----------	2,671,076	Tons	[d]19.75	49,749,000
1929	----------	----------	2,022,417	"	[d]29.36	59,387,000
Cabbage 1928	137,170	7.18	984,200	"	23.51	23,138,000
1929	157,220	6.80	1,069,400	"	19.87	21,254,000

UNITED STATES CROP REPORT: DECEMBER, 1929—Continued

Crop and Year	Acreage	Production: Per Acre	Production: Total	Production: Unit	Farm Price on Dec. 1 Per Unit	Total Farm Value Based On Dec. 1 Farm Price
					Dollars	Dollars
Corn, sweet (Canning) 1928	305,960	1.93	592,900	"	12.64	7,497,000
1929	331,070	1.93	639,300	"	13.19	8,431,000
Cucumbers 1928	110,020	79	8,656,000	Bushels	1.08	9,356,000
1929	111,540	77	8,644,000	"	1.39	12,054,000
Onions 1928	80,020	256	20,454,000	"	1.18	24,099,000
1929	86,570	299	25,867,000	"	.74	19,039,000
Strawberries 1928	206,920	1,616	334,331,000	Quarts	.137	45,711,000
1929	198,560	1,669	331,441,000	"	.135	44,873,000
Tomatoes 1928	399,730	3.49	1,394,000	Tons	29.60	41,261,000
1929	434,370	4.25	1,846,000	"	27.51	50,777,000
Watermelons 1928	206,930	297	61,380,000	Number	[f]178.00	10,938,000
1929	203,560	321	65,283,000	"	[f]176.00	11,514,000
U. S. total with duplications eliminated 1928	[a]362,673,330	----------	----------	----------	----------	[g]8,495,788,000
1929	[a]367,082,180	----------	----------	----------	----------	[g]8,580,528,000

[a]U. S. totals include several minor crops not shown in the table. [b]Pounds. [c]Per pound. [d]Total except hay. [e]Prices other than December 1. [f]Production is the total for fresh fruit, juice, and raisins, including grades not harvested. [g]Per 1,000 melons. [h]Values based on prices shown for each crop.

IOWA CORN MOISTURE STUDY, OCTOBER, 1929

Districts	Average Date Gathered (Oct.)[a]	Total Number of Samples Tested	Total Number of Fields From Which Samples Were Gathered	Total Number of Ears Used in Samples	Average Moisture Content (Per Ct.)	Weights Used (Per Ct.)
Northwest No. 1	11	22	173	1,716	25.0	15
North Central No. 2	11	21	162	1,173	27.9	10
Northeast No. 3	11	19	152	1,151	29.0	7
West Central No. 4	11	20	165	1,156	26.8	17
Central No. 5	12	20	163	1,350	26.6	15
East Central No. 6	12	17	120	852	27.6	9
Southwest No. 7	13	10	77	607	31.5	11
South Central No. 8	11	16	117	1,011	31.4	8
Southeast No. 9	11	13	89	644	32.1	8
For State	11	158	1,218	9,669	*28.14	100

*Weighted according to percentage of acreage husked in 1928.

The 158 samples tested for the above summary were obtained from 93 counties. The total number of ears in the samples was 9,669, or 7.94 ears per field, 61.2 ears per sample and 7.7 fields per sample. Thirty-four samples gathered after October 15 were tested but not used in the summary.

The average per cent of moisture, 28.14, obtained by weighing, is about 4.71 per cent wetter than was obtained by a similar test made on the same date in October, 1928, allowance being made for loss of moisture in shipment in 1928.

IOWA CORN MOISTURE STUDY, 1929
(November)

District	Average date gathered —November	Total number of samples tested	Total number of fields, or cribs from which samples were gathered	Total number of ears used in samples	Average moisture content—Per Cent	Weights used (Per Cent)
Northwest	20	15	86	879	20.4	15
North Central	19	21	142	1,168	21.0	10
Northeast	20	15	71	672	21.9	7
West Central	21	18	106	865	20.5	17
Central	20	23	127	1,066	20.5	15
East Central	20	16	100	755	21.8	9
Southwest	20	10	70	680	22.0	11
South Central	20	15	108	847	22.4	8
Southeast	20	13	91	635	22.1	8
State	20.2	146	901	7,597	*21.20	100

*State average moisture content weighted according to the percentage of corn husked in each district in 1928, on acreage basis, as reported by assessors.

The 146 samples tested for the above summary were obtained from 89 counties and 91 fields and cribs. The total number of ears in the samples was 7,597 or 8.4 ears per field, 52.0 ears per sample and 6.2 fields per sample.

This year a further step was taken to obtain the average weight per measured bushel of shelled corn according to Federal Grain Standards. The average weight for the State was shown to be 52.5 lbs. per bushel. The average weight for Dist. 1 is 51.2 lbs.; Dist. 2, 51.4 lbs.; Dist. 3, 51.8 lbs.; Dist. 4, 52.6 lbs.; Dist. 5, 53.4 lbs.; Dist. 6, 53.0 lbs.; Dist. 7, 52.6 lbs.; Dist. 8, 53.5 lbs.; Dist. 9, 53.3 lbs.

The estimate as of December 1, 1929, showed an average yield of 40.0 bushels per acre, which, according to this study had a moisture content of 21.2 per cent on November 20. To place this on a No. 2 contract grade basis, it would be necessary to reduce the moisture content to 15.5 per cent which would leave a yield of 36.9 bushels of No. 2 corn per acre.

CORN BY STATES*

State	Acreage Harvested (Thousands)		Yield Per Acre (Bushels)		Production (Thousand Bushels)		December 1 Farm Price (Cents Per Bushel)	
	1928	1929	1928	1929	1928	1929	1928	1929
New England	217	222	42.4	41.1	9,100	9,125	121	114
New York	650	676	34.0	31.1	22,100	21,024	99	103
New Jersey	181	183	38.5	36.0	6,968	6,588	97	101
Pennsylvania	1,283	1,300	39.0	35.5	50,037	46,470	93	100
Ohio	3,646	3,518	37.5	36.5	136,725	128,407	76	78
Indiana	4,483	4,124	35.2	32.0	157,802	131,968	69	74
Illinois	9,570	8,900	38.4	35.0	367,488	311,500	70	72
Michigan	1,461	1,344	33.5	24.5	48,944	32,928	84	89
Wisconsin	2,121	2,006	42.0	40.0	89,082	81,440	78	83
Minnesota	4,089	4,253	34.0	35.0	139,026	148,855	62	65
Iowa	11,202	10,944	41.5	40.0	464,883	437,760	67	70
Missouri	6,260	5,384	29.0	23.5	181,540	126,524	73	86
North Dakota	997	1,067	24.5	15.5	24,426	16,384	61	68
South Dakota	4,469	4,916	21.0	22.8	93,849	112,085	62	62
Nebraska	8,937	9,144	23.8	26.0	212,701	237,744	71	69
Kansas	6,634	6,103	27.0	17.5	179,118	106,802	65	74
Delaware	136	132	33.0	32.0	4,488	4,224	88	88
Maryland	536	525	36.5	36.5	19,345	19,162	88	88
Virginia	1,626	1,522	27.5	29.0	44,715	44,138	100	100
West Virginia	459	441	36.0	31.5	16,524	13,892	103	100
North Carolina	2,305	2,259	18.5	21.5	42,642	48,568	103	100
South Carolina	1,422	1,422	12.0	16.4	17,064	23,321	106	99
Georgia	3,620	3,656	10.5	13.8	38,010	50,453	105	88
Florida	607	625	13.0	13.5	7,891	8,438	100	85
Kentucky	3,029	2,938	22.0	27.5	66,638	80,795	96	91
Tennessee	2,915	2,944	19.5	25.0	56,842	73,600	100	92
Alabama	2,650	2,676	11.5	14.0	30,475	37,464	110	98
Mississippi	1,765	1,765	14.0	20.0	24,710	35,300	102	93
Arkansas	2,002	1,882	17.0	14.0	34,034	26,348	91	98
Louisiana	1,242	1,180	17.0	18.2	21,114	21,476	94	90
Oklahoma	3,050	3,093	23.0	16.0	70,150	48,320	68	79
Texas	4,722	4,533	21.0	19.0	99,162	86,127	78	85
Montana	274	301	19.0	12.0	5,206	3,612	82	84
Idaho	53	54	46.0	36.0	2,438	1,944	92	94
Wyoming	167	177	16.0	16.0	2,672	2,832	75	85
Colorado	1,438	1,366	13.0	17.0	18,694	23,222	68	75
New Mexico	199	209	17.5	20.0	3,482	4,180	89	89
Arizona	39	41	26.0	28.0	1,014	1,148	125	130
Utah	18	19	29.0	31.0	522	589	110	100
Nevada	2	2	22.0	28.0	44	56	112	120
Washington	46	48	39.0	38.0	1,794	1,824	99	103
Oregon	82	86	36.0	35.0	2,952	3,010	100	98
California	75	82	32.0	31.0	2,400	2,542	105	112
United States	100,673	98,018	28.0	26.8	2,818,901	2,622,189	75.2	78.1

*This table covers corn for all purposes, including hogged and siloed corn, and that cut and fed without removing the ears, as well as that husked and snapped for grain. The yield for grain, with an allowance for varying yields of corn for other purposes, is applied to the total acreage to obtain an equivalent production of all corn.

SECULAR TREND OF IOWA PRECIPITATION

By Charles D. Reed, Weather Bureau, Des Moines, Iowa

Before entering upon such a study as this, careful consideration must be given to the source and comparability of the data. One is always anxious to use a continuous record that extends back as far as possible. City rainfall records must be used with care for they have usually been obtained in two or more locations, each on a higher building than its predecessor or surrounded by higher buildings. Records in the smaller towns are usually made by co-operative observers and very few are continuous and comparable for periods of more than 40 years. In a trend study, 40 years is scarcely long enough to make a good beginning, yet the layman equipped with only 40 years or so of more or less fickle memory, and little or no exact and comparable records, often expresses profound conclusions as to changes in climate; and the multitude marvels at his wisdom. To the meteorologist, 100 years are but as a day.

In Iowa, or near its borders, extending back to 1873, there are nearly 200 rainfall records, varying from a few years to more than 50 years in length. Probably not one of these records could be regarded as ideal for a trend study, yet it seemed a pity not to utilize such a wealth of material in some such study, so an effort was made to determine precipitation trends on a basis of areas instead of stations.

Early in the 70's rainfall records were much more numerous per unit area in the northeastern counties than elsewhere in the State, but at the present time such records are more numerous in the northwestern portion. It is obvious that a straight average of the total number of reports would not be a true State average. The preponderance of stations in the rainier northeast portion of the State in the earlier years, compared with the present preponderance in the drier northwest portion, would produce an apparent but false downward trend in State averages. To correct this the State was divided into nine districts, of as nearly equal area as county boundaries would permit, and including about 11 counties in each, viz., northwest, north-central, northeast, west-central, central, east-central, southwest, south-central and southeast. By considering all available data just outside the border as well as inside each district, it was possible to make satisfactory district averages of rainfall for each month for 53 years from 1875 to 1927. Data from adjoining States were included when very near the border of a district.

The trend of annual and seasonal State and district averages, thus refined, was calculated by the formula $I=\frac{\Sigma DY}{\Sigma Y^3}$ in which I is the annual increment (or decrement), D is the average rainfall of each year, and Y the number of each year, starting from the middle year, numbering up and down and prefixing a minus sign to all years before the middle year. The mean rainfall of the series is entered opposite the middle year and the annual increment or decrement added successively each way till the first and last years of the series are reached. The totals of precipitation at the end of each year represent points in a series of events, so the number of intervals between points is one less than the number of years. To cover

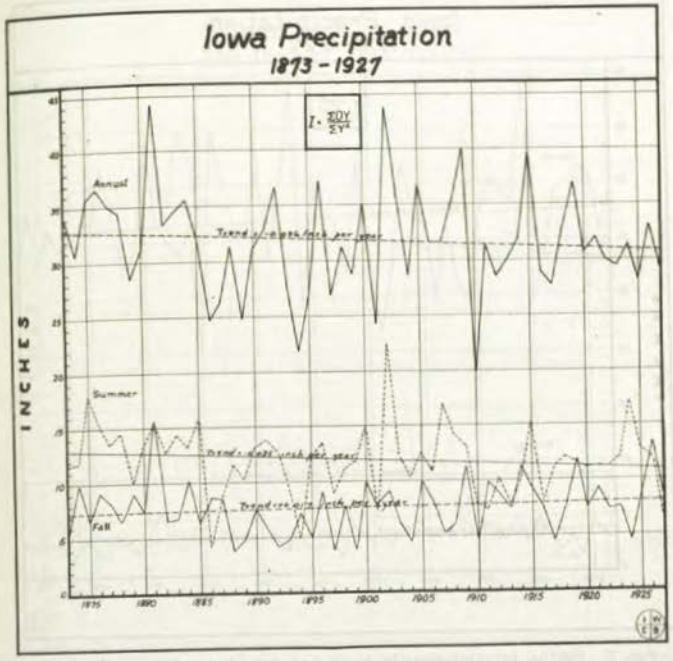


Fig. 1. Annual precipitation in Iowa has decreased at the rate of 0.036 inch per year for 55 years. Summer rainfall has noticeably decreased or been partly transferred over into the fall months.

the full period it is necessary to project the trend line backward through the first year of the series; so in practice, the annual increment, I, is multiplied by one more than the number of years preceding the middle year and the product added (algebraically, since I may be either positive or negative), to the mean of the whole series to get the value of the beginning of the trend line, on January 1 of the first year. With simple events, each of which does not represent an appreciable period of time, this amplification is not necessary.

For the 12 calendar months the annual decrease in rainfall for the State as a whole is —0.036354 inch or 2.00 inches in 55 years. The annual averages and trend line for 55 years, 1873-1927, are shown on the accompanying graph, (Fig. 1).

From an agricultural standpoint, the trend in certain seasons might be important. For the summer months, June, July and August combined, the annual decrement for the State as a whole is —0.034925 inch (Fig. 1). This is a total of 1.92 inches or 15% in 55 years. Apparently an appreci-

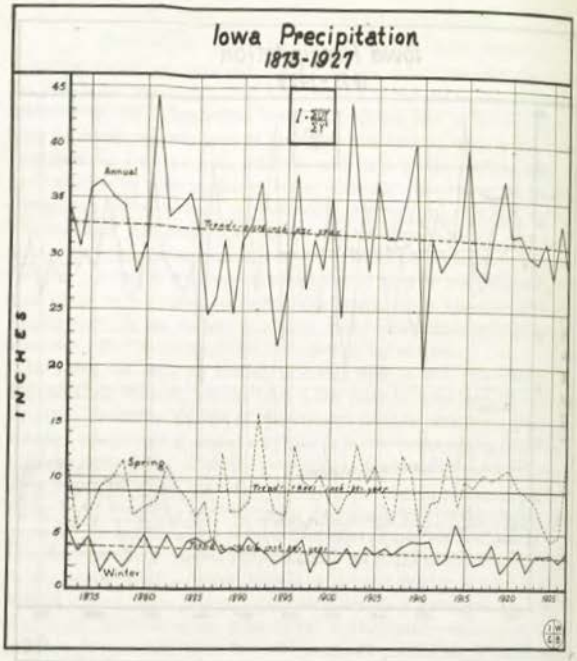


Fig. 2. Spring precipitation in Iowa has not changed appreciably in 55 years but winter precipitation has decreased 39%.

able amount of rain has been transferred from summer to fall. About half of this decrease is made up by a total increase of 0.95 inch in the fall months, September, October and November (Fig. 1), when it is a positive detriment to the maturity and harvesting of Iowa's great corn crop. The spring seeding and planting months of March, April and May, show almost no change, amounting to an increase of only 0.06 inch in 55 years (Fig. 2).

Winter precipitation (December, January and February) shows a total decrease of 0.90 inch, or 39% in 55 years (Fig.2). Reckoned in per cent, winter shows the largest relative decrease.

Southwest Iowa has had the largest actual decrease. In the nine counties of the southwest district the total decrease in 53 years is 3.41 inches, 10%, or at the rate of 0.064321 inch per year (Fig. 3).

As the district averages were rather weak in some districts in the years 1873 and 1874, these years were omitted from the district trend studies though included in the State trends. The records of the Weather Bureau in Omaha had a marked effect on the trend in the southwest district for they were continuous without a break through the 53-year period con-

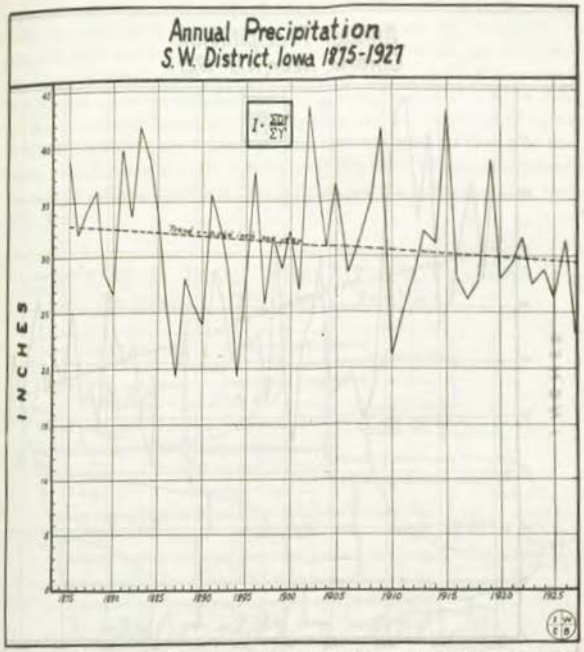


Fig. 3. The greatest decrease in Iowa precipitation is in the southwest district where it amounts to 3.41 inches in 53 years.

sidered. The Council Bluffs records just across the Missouri River from Omaha also had a marked effect during the earlier years when they were nearly unbroken. A trend colculation of the Omaha record shows a remarkable decrease of 0.262168 inch per year, or a total of 13.89 inches in 53 years, or 39%, (Fig. 4). The nearest station having a record useful for comparing trend is Weeping Water, Nebraska, where, with a few interpolations, 51 years, 1878 to 1928, are available. Here the total decrease is 4.48 inches, 14%, or at the rate of 0.087867 inch per year. For the State of Nebraska as a whole in the 53 years, 1876-1928, the total decrease is 1.56 inches, 6%, or 0.029439 inch per year.

The only station actually in the southwest district having a record warranting a trend calculation is Clarinda. Including interpolations recently made for use in the forthcoming revision of Hann's Climatology, for the years 1878 to 1887 inclusive, it is possible to make a 53-year trend, 1876-1928 inclusive, which shows an annual *increase* of 0.035030 inch, or a total *increase* of 1.86 inches, or 5.8 per cent, instead of a decrease.

Either there must be an area centering about Omaha where there is an abnormal long time downward trend, or else some sort of unfavorable

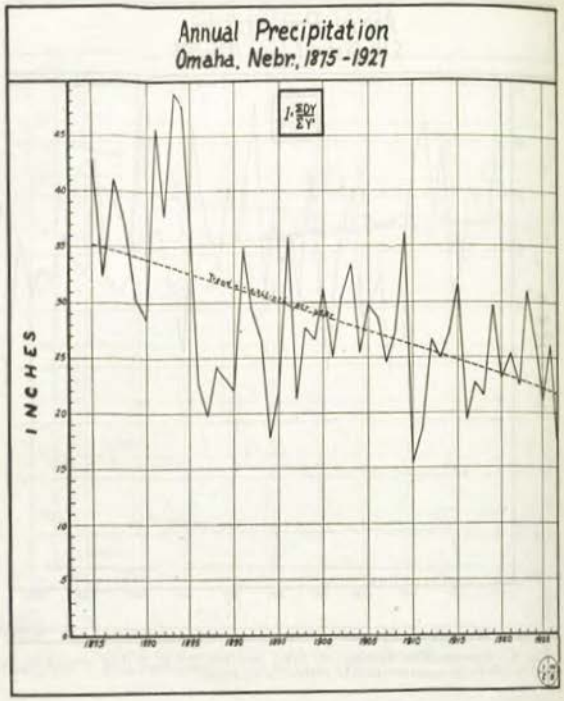


Fig. 4. The greatest decrease in the region is centered at Omaha where it amounts to 12.89 inches or 30% in 53 years.

conditions not readily apparent are developing and progressing in connection with the exposure of the rain gage. The rainfalls of the 80's were very heavy at Omaha, which gives the trend line a steep downward slope.

The averages for the west-central district were but slightly influenced by the Omaha records, yet the total decrease in that district in 53 years is 2.35 inches, 7%, or about 0.044318 inch per year. Next stand the east-central and northeast districts, each with a decrease of 2.29 inches. At Independence, Buchanan County, in the northeast district, the total decrease in rainfall is 4.66 inches, or 14% in 59 years, 1869-1927. This is at the rate of 0.079015 inch per year. At Dubuque, Dubuque County, also in the northeast district, the total decrease is 4.89 inches, or 14% in 77 years. This is at the rate of about 0.063550 inch per year. The least decrease is in the northwest district, where it amounts to only 0.20 inch. Algona, Kossuth County, near the middle of the northern boundary of the State, shows,

not a decrease, but a total increase of 0.21 inch in 55 years, in spite of the claim that drainage of northern Iowa land has reduced the rainfall. In fact, this study shows the greatest decrease in rainfall is in the southwest district where there has been the least drainage of land. State-wide records in Minnesota are not of sufficient length to be comparable with Iowa data; but the total increase in rainfall at Fort Snelling and St. Paul is 1.19 inches in 91 years, 1837-1927, and it seems probable that the general trend of Minnesota rainfall is upward. The distribution of the total decrease in precipitation in 53 years by districts in Iowa is shown on the accompanying map, (Fig. 5).

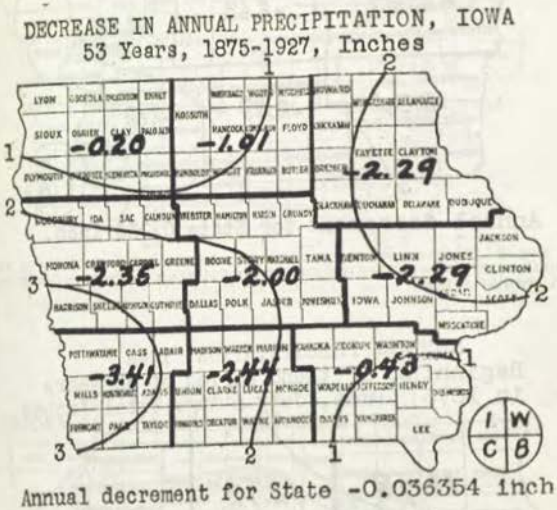


Fig. 5. Iowa precipitation has decreased markedly from southwest to northeast but very slightly in the northwest district.

The trend by districts for the three principal crop months, June, July and August combined, is shown on the accompanying map, (Fig. 6). Here again the largest decrease is in the southwest district, where it is 3.34 inches, or 23%, and almost the same as for the entire year. Next is the west-central district, with a decrease of 2.97 inches, which coincides with the impressions of farmers who have farmed in that district for a lifetime and who furnished part of the inspiration for this study. The least decrease in summer rainfall is in the north-central district, 1.06 inches.

The values of the ends of the trend lines of the nine districts were entered on maps to show just how the summer precipitation of 53 years ago would compare with that of 1927. These are shown by maps (Figs. 7 and 8).

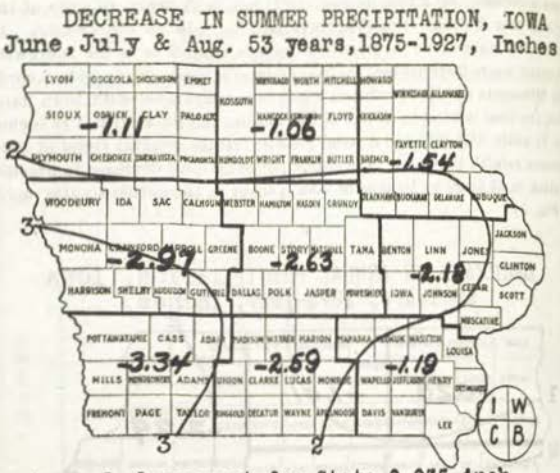


Fig. 6 Summer precipitation in Iowa has decreased decidedly in the southwest, and west-central districts, around which the decrease diminishes in regular zones.

Fig. 7. Southwest Iowa had much superfluous summer rainfall 53 years ago.

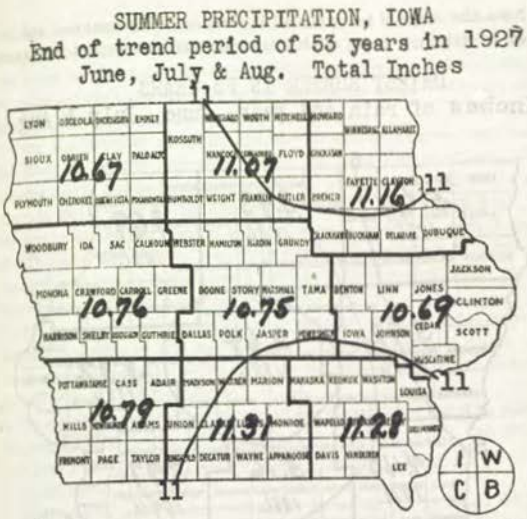


Fig. 8. After 53 years, the present distribution of Iowa summer rainfall has settled down to what appears to be a normal, stable, distribution over the State.

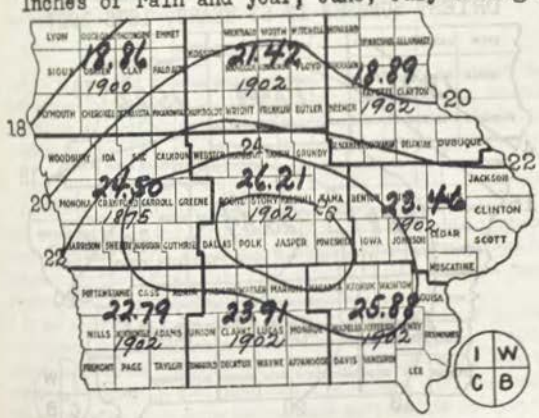


Fig. 9. The central district holds the record for wettest summer which occurred in 1902.

Note the center of heavy rainfall 53 years ago in the southwest and the area of relatively heavy rainfall extending northeast beyond the center

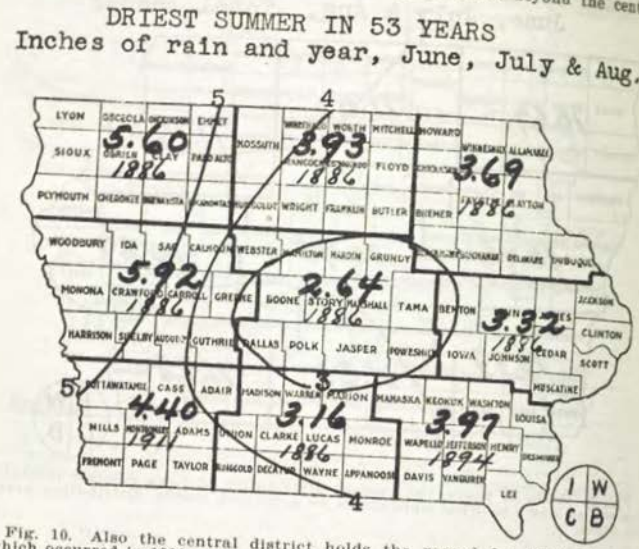


Fig. 10. Also the central district holds the record for driest summer which occurred in 1886.

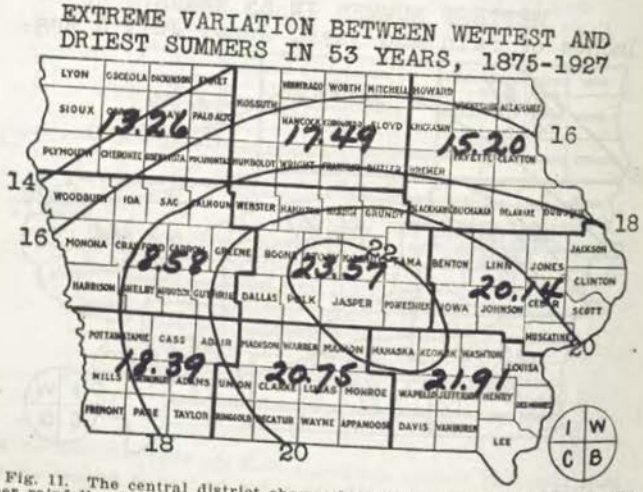


Fig. 11. The central district shows the most extreme variation in summer rainfall, while the northwest district is most constant.

of the State. Note also that at the end of the period the differences have become leveled down so that there is now a range of only 0.64 inch between the driest northwest district and the wettest south-central district, while 53 years ago the range was 2.34 inches between the driest northwest district and the wettest southwest district.

Corn, if affected at all by this decrease in summer rainfall, has been benefited, or, possibly improved farming has more than overcome any adverse effects, for the trend in corn yield per acre has been upward in all districts for 40 years, though the improvement in corn has been least in the southwest and south-central districts, where it amounts to only a gain of 0.18 bushel per acre per year. The greatest concentration of acres of corn per unit area, is in the western districts, so there was evidently much superfluous rainfall in the earlier years.

The record wet summer was 1902 in all districts, except the west-central, where the summer of 1875 was the wettest, and the northwest where the summer of 1900 was the wettest; and the wettest district was the central in 1902 with 26.21 inches (Fig. 9).

The record dry summer was 1886 in all but the southwest district, where the driest was 1911 with 4.40 inches, and the southeast where the driest was 1894, with 3.97 inches; and the driest district was the central in 1886, with 2.64 inches (Fig. 10).

In extreme variation of summer rainfall the central district leads with a range of 26.21 inches, and the northwest district is least with 13.26 inches (Fig. 11). This small variation in rainfall, combined with a drouth resistant soil, explains the dependability of the northwest district in corn production. At the end of the trend period in 1927, the northwest district has 38% of its annual rainfall in the summer, leading in this feature over all the other districts, while the east-central district has the least, 33%. At the beginning of the period the west-central district led with 44%, and the east-central and southeast were least with 37%.

SUMMARY

Iowa is becoming steadily drier but up to this time the tendency has not proceeded far enough to threaten its principal crop, corn; in fact, conditions for corn seem to be improving. There is no doubt a limit, but probably the trend will change before the danger line for corn is reached.

WEATHER OBSERVATORY AT DES MOINES

On October 1, 1929, the Weather Bureau Office in Des Moines moved to new quarters and entered upon a new era in its work. Not until that date could it be said that at Des Moines or anywhere in Iowa and at but few places in the United States there was a structure of the design and equipment to merit the term Meteorological Observatory.

In the fine new rooms below the observatory are the offices of the Section Center of the Climatological Service of the United States Weather Bureau for Iowa and the co-operating organization known as the Weather and Crop Bureau of the Iowa Department of Agriculture. This constitutes the central office which equips and maintains more than 100 co-operative weather observing stations well distributed over the State, supervises the work of the observers, checks and tabulates the reports and publishes

monthly and annual Climatological Data summarizing the reports. Weather forecasts for Iowa are amplified and distributed by press, radio, mail and telephone. On most any busy day 500 telephone calls are answered including many long distance calls from paving contractors, shippers, tourists, etc. River gage records are maintained at several stations on the Des Moines, Raccoon and other rivers. These records are extensively used in planning improvements of all sorts along the rivers; also flood warnings are issued when needed. Much time and effort is devoted to weather reports and forecasts to aid fliers. There are many other activities that cannot be treated in the space available.

The Weather and Crop Bureau of the Iowa Department of Agriculture supervises the work of 1,609 townships and 811 town assessors in collecting agricultural statistics from approximately 210,000 farms of the State; checks, tabulates and publishes those statistics and assists the U. S. Bureau of Agricultural Economics in preparing and disseminating the monthly crop reports.

Many brief, interesting articles on weather, crops and agricultural economics are furnished for publication in the News Service of the Iowa Department of Agriculture which is extensively used by the country newspapers and the city dailies.

HISTORICAL

Thermometers were read at Fort Des Moines at sunrise, 2:00 p. m., sunset and 9:00 p. m., from October, 1843, to February, 1846, except October, November and December, 1845. Rainfall was measured from June, 1844, to February, 1846, except as above. No further record is known till that kept by George A. Jewett, and published in the Des Moines Register, 1867-1877. A voluntary observer conducted a so-called "Sunset" station in Des Moines, August, 1877, to July, 1878, followed immediately by the Signal Corps of the United States Army, now known as the United States Weather Bureau.

The first office of the Signal Corps was in the northwest room on the second floor of a two-story building known as the George D. McCaine Block, northeast corner Sixth and Walnut Streets, August 1, 1878, to December 31, 1887. The thermometers, maximum, minimum, wet and dry, were exposed in a small shelter attached to the outside of a north window of the top story, 35 feet above the ground. The rain gage was on the roof, 45 feet above ground; anemometer and wind vane on the roof, 60 feet above ground; elevation of barometer in the office, 843.0 feet above sea level.

From January 1, 1887, to March 31, 1889, the office was in the Clapp Block, southwest corner Fifth and Walnut Streets, at that time a four-story building, the highest in the vicinity. Here the elevation of the barometer was 859.5 feet above sea level, thermometers in a standard Weather Bureau shelter, 11.1 feet above the roof, and 73.8 feet above ground; anemometer on roof, 78.5 feet above ground; rain gage on roof, elevation 65.3 feet above ground, January 1-December 9, 1887, then 64.1 feet till March 31, 1889.

From April 1, 1889, to September 30, 1929, the office was on the fourth floor of the old United States Court House and Postoffice Building, four stories high, at the northeast corner Fifth and Court Streets, where the elevation of the barometer above sea level was 861.1 feet. All prior and

subsequent barometer readings are reduced to this level, which has been adopted as the standard barometer elevations for Des Moines. Other instruments on the roof; thermometers in a standard shelter, the bottom of which was 11 feet above the roof, and thermometers 84 feet above the ground; anemometer 15 feet above roof and 88 feet above ground, till February 26, 1902, when it was raised to 27 feet above roof and 100 feet above ground. During the year 1904 it was raised 1 foot, to 101 feet above ground. October 31, 1910, it was lowered to 97 feet above ground, where it continued till September 30, 1929; top of rain gage 3 feet above roof and 75 feet above ground. Some time in 1904 the rain gage was raised 1 foot.

For 40 years and 5 months the positions and elevations of the instruments were not essentially changed, except the anemometer as noted above; yet the growth of buildings 12 to 18 stories high to the north and west and somewhat higher than the Federal Building in other directions, except a narrow sector to the south and southwest, produced artificial conditions that interfered with the record of wind direction, wind velocity and sunshine, and under some conditions gave trouble with the temperature, but apparently had little or no effect on the precipitation. January 1, 1928, a 3-cup type of anemometer went into use at all Weather Bureau stations, in place of the 4-cup type that had been used from the beginning. The 4-cup anemometer recorded too much wind, particularly at high velocities. This has been largely overcome in the 3-cup instrument.

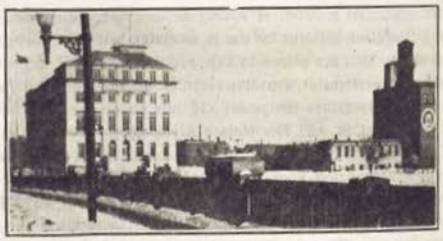
On October 1, 1929, the office was moved to the New United States Court House, East First and Walnut Streets, where a special room 12½ feet square is built into the roof in such a manner that the observer on duty can work at his desk and with an occasional glance, see the sky in all horizontal directions, and to a considerable altitude. The barometers, barograph, quadruple register, or station meteorgraph, equipment for inflating and liberating balloons for use in obtaining height of lower clouds, telethermoscope, etc., are placed in this room, on the roof of which are the wind vane, anemometer, sunshine recorder, nephoscope, and rain trace catcher. The temperature equipment and rain gages are in a city park between East First St. and Des Moines River, about 170 feet southwest of the United States Court House. The thermometers are in a standard instrument shelter, 5 feet above sod, within a fenced area 16 by 24 feet. The fence is constructed of slender iron pickets 4 feet high. The rain gages are at the west end of the inclosure, with the tops of the gages 3 feet above the sod. For precipitation falling as rain, when freezing temperatures are not expected, the tipping bucket gage is used. This electrically records each 0.01 inch of rain on the revolving drum of the quadruple register or station meteorograph, in the roof observatory, with which it is connected by more than 500 feet of electric cable. This is supplemented by the Fergusson weighing gage which automatically records snow or other solid forms of precipitation, as well as rain, on a clock driven drum within the gage.

The temperature equipment includes the usual maximum, minimum, wet bulb and dry bulb thermometers, a thermograph which makes a continuous record of temperature by a pen line on a sheet of paper on a clock-driven

drum, and the bulb of the telethermoscope by which the temperature in the shelter, in the park, can be ascertained in the observatory in the roof, by pressing a button which sends a current through the bulb, consisting of a coil of wire, the resistance of which is measured in the observatory by a Wheatstone's bridge apparatus. When the bulb is warm its resistance is high, and when it is cold its resistance is low. The scale on the indicator in the observatory is graduated to indicate the resistance, not in ohms as usual, but in equivalent degrees of temperature.

The elevation of the anemometer is 99 feet above the ground and 18 feet above the roof, compared with 97 feet and 24 feet at the preceding location. Comparative wind velocity records are being maintained in the old and new locations. The river and its skirting of parks and low buildings of the "civic center," together with the improbability of the construction of high buildings to the eastward, will give a free exposure to the wind instruments that will be truly representative of wind conditions in central Iowa for at least a generation.

The bird's-eye view of the new United States Court House, and vicinity below, looking east, shows the upper part of the observatory built into the roof of the building, with the wind instruments above the roof of the observatory. The sunshine recorder is mounted on the south railing of the roof. The instrument shelter and rain gages can scarcely be seen because of their relatively small size, at the extreme right, below the advertising sign, U. S. In the middle foreground in a niche in the pier of the Walnut Street bridge, over the Des Moines River, is the mechanism that continuously records the stage of the river by means of a float that is suspended in a well in the pier, consisting of a 9-inch iron pipe extending down inside the pier to a horizontal pipe forming an inverted T resting on the river bed.



Bird's-eye view of new U. S. Court House, observatory rain gages, thermometer shelter and river gage.

OLD FEDERAL BUILDING

Northeast corner West Fifth and Court Streets. Looking northeast. Note the thermometer shelter on the roof near the right of the picture. The sunshine recorder was on top of the shelter. The wind vane and anemometer support is faintly visible to the right of the tower near the smoke-stack. The rain gage was near the foot of the anemometer support, sheltered by a wall around the roof, four feet high.

NEW U. S. COURT HOUSE

Southeast corner East First and Walnut Streets. Looking northeast. Note the comfortable observatory room built into the roof and connected by an easy stairway, with the offices which occupy most of the fourth floor back to the large south jog of the building. Wind instruments on observatory roof; sunshine recorder on south rail of roof, too small to show in the picture; thermometer shelter and rain gage in fenced area in park in foreground.

INDEX